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EDITORIAL NOTES.

The Gas Institute Meeting.

FROM present appearances, the annual meeting of the Incorporated Gas Institute promises to be of great interest, both in its technical and social aspects. Southampton, the home of the President (Mr. S. W. Durkin), is to be the place of meeting. Its situation perhaps is rather inconvenient for a large number of the members; but the attractions of the occasion will, it may be said with certainty, draw to the celebrated seaport a gathering of which Mr. Durkin will be proud. The sittings for business and technical work will extend from Tuesday, June 10, to the following Thursday; and Friday will, as is customary, be given up entirely to the joys of an excursion. On Tuesday morning, the members will be honoured by a civic welcome; the Mayor having expressed his intention of receiving them on behalf of the town. The Chairman and Directors of the Gas Company will join in this reception; and their courtesy will be crowned by an entertainment at luncheon the same day. At the morning sitting there will be the President's Inaugural Address; and this will be followed by a discussion on the situation of the amalgamation question. It is devoutly hoped by many that this will leave the matter with an unobstructed road to unity. Subsequently the reading and discussion of papers will be commenced, and then continued at Wednesday's and Thursday's sittings. It is understood that there will be something like nine or ten papers on varied subjects. On Wednesday morning, there will be an interruption in this part of the programme, in order to give place to a lecture by Mr. James Swinburne, M.Inst.C.E., on "Electrolysis and Electric Traction." This is a subject which has in it the making of a splendid lecture by an Electrical Engineer of the acknowledged standing of Mr. Swinburne; and it is a subject in which many gas engineers are already concerned, and many more expect to become involved sooner or later. Therefore, it is easy to promise the lecturer that he will have a full attendance of the members who are present at Southampton, and a heedful audience. After the technical work is ended on Thursday, the visitors will give themselves up to pleasure; and the President will lead off with a reception in the evening. The whole of Friday will be taken up by an excursion to the Isle of Wight—the itinerary being Southampton, Ryde, Carisbrooke, Blackgang, Ventnor, Shanklin, and thence to Southampton. With favourable atmospherical conditions, this should provide a day of real relaxation and recreation. The programme has not been completed yet; but this early sketch of the projected arrangements should be sufficient to induce a large proportion of the members to make every possible effort to get down south for the week in June.

The Method of Stating Carbonizing Costs.

AMONG the papers and revised reports of discussions forming part of the proceedings at the meeting of the Institution of Gas Engineers which we publish to-day will be found the contribution of Mr. W. R. Herring, in which he suggests a unification of the methods of stating carbonizing costs. His idea is that a Committee should be appointed to look into the matter; and, as is expected of an advocate, he, in the paper, advances some excellent reasons for making an effort to evolve a rational system on which accurate comparisons can be made. To his proposal there has been no public opposition, nor upon it any serious criticism; but, privately, views have been expressed which show a little scepticism as to any good coming out of the suggestion, and also a little ignorance as to what is actually intended. We should be sorry if the project fell to the ground, without an essay being seriously made to ascertain whether its useful fulfilment is possible, through the influence of prepossessed views as to its futility. Mr. Herring's original proposal contemplated the direct appointment of a Committee by the members of the Institution to consider the question; but an amendment which referred the matter to the Council for consideration, with power, if thought desirable, to appoint a Committee, was carried. This reference, as opposed to the direct election of a Committee by the members, will cause delay; but this (if not unduly prolonged) will not much matter if it results in the selection of a Committee particularly qualified for the task, which might not have been the case had the appointments been hurriedly made.

Now let us examine one or two of the points which have been privately raised in connection with this suggested unification of the methods of stating items comprising carbonizing costs. Some little doubt seems to exist as to the length to which it is intended to apply any rule which may be propounded. So far as we understand Mr. Herring and others who are desirous of seeing some acceptable method formulated—and this is our own view—all that is required is the establishment of a standard for professional direction in making comparisons in technical discussion and writings, in order that the present want of congruity may be averted. There is no suggestion—it would be foolhardy if there were a suggestion—of its application beyond this. "Why should I," inquired an engineer of us the other day, "alter my present methods of calculating my costs to please "anybody?" Nobody has asked an engineer to do so, nor does anybody even suggest he should do so, save on certain occasions, when it will be for the common good. Then there are those who hint that the uniform basis of stating carbonizing costs would not be acceptable to all engineers who had adopted plant which was not producing the results expected. There is a weakness about this which tempts a little sharp criticism; but perhaps the less said about it the better. Then there are engineers who are of opinion that there are questions other than costs connected with the inclined retort system which require investigation. That may be; but who will contest that the costs of production are not to-day the final test of a system's efficiency? One eminent engineer suggested, in conversation the other day, that the question of the slipping of some classes of coal in inclined retorts is of far more present importance than that of cost, from the point of view that this drawback did not allow the gas engineer the freedom in purchase of coal that he possesses with horizontal retorts. There may be something in this argument. But there is also something in the argument that there are many coals which, experience proves, have not this disqualification; and if the reducing of the methods of stating costs to a systematic basis sets the fact beyond the bounds of controversy that the inclined system is the cheaper form of carbonization for these coals, then something of great importance will have been achieved. Then, again, it is pointed out that the differences in local circumstances and other matters (presumably such as those mentioned in Mr. Herring's paper) present difficulties which will prevent anything in the nature of a uniform basis of comparison being instituted. But are local circumstances and such like to always form obstacles in the way of a search after truth? We hope not; and if a Committee can be found who are willing to investigate the matter to see whether the difficulties can be encompassed, and if they are successful, then they will have done something which, in professional intercourse, will be of great practical and technical value.

We cannot conceive of anyone who is a member of such a profession as that of gas engineering rolling any objection in the way of an effort which only aims at enlightenment and knowledge. The high instincts of the man whose profession is something more to him than a mere means of obtaining a livelihood cannot exist in such a one; and it is to be hoped that no man of that character will be allowed to have any influence in rendering nugatory the proposition put forward by Mr. Herring. Of concerted action in the gas industry to examine into things outside the common groove, there is little enough as it is. There is good and laudable individual exertion here and there; but there is little of that community of interest in inquiry which we see in other branches of the engineering profession, and which is found in connection with the technical societies of the gas industry on the Continent and in America. Therefore, we look,

with more than passing interest, to the result of the deliberations on this question of the Council of the Institution. Many there are in the profession who bewail the flatness of the proceedings at some of the meetings of the technical associations; and many there are, we know, who absent themselves on the ground that the meetings are valueless in contributing to the animation of their professional life. Here in Mr. Herring's proposition is a suggestion, which, if adopted, and a Committee formed who will submit for acceptance a standard on which to base comparisons of carbonizing costs, will, we feel sure, open up the way to many a brilliant and instructive discussion. This alone would be worth the time devoted to it by a Committee; and if happily the consideration gave us a standard which would eventually replace the present capricious methods of stating costs, so much the better. Horizontal retort men may deride the idea; but let them remember that the suggestion for unification in its present form has come from the inclined retort side. Therefore, the inclined being the newer system, opposition would ill-become them. Mr. Herring's paper shows that a definitive method of stating costs will not hold fear for at least one of the exponents and champions of the system; and we know there are others.

Some Further Reflections on the Institution Meeting.

Mr. Livesey's discourse upon gasholders at the meeting of the Institution was admittedly one of the most interesting and instructive of the contributions to the technical portion of the transactions. It was practically a lecture, as from a professorial chair; and no engineer who heard it could have felt otherwise than that his perceptions of the subject-matter were considerably heightened thereby. Our object in returning to the subject is not to add anything to what was said on this occasion by Mr. Livesey or his commentators, but merely to draw attention to an aspect of the matter which was not explicitly disclosed at the meeting. It is that, so far as either theory or practical knowledge can tell us, the design and construction of gasholders is one branch of engineering which has reached finality. Whether it be for size, or cheapness, or bold originality of conception, existing examples of these engineering structures are not likely to be surpassed, or even improved upon. This is the result of the remarkable development of the study of the subject, and the sudden expansion of gasholder building, which dates from the early and middle "eighties." What was then achieved holds the field, which is sound proof of its merit. Incidentally, the fact also holds out some hope that similar concentration of attention upon other branches of gas engineering will not be thrown away. It has been so, indeed, in regard to one other technical study which has in its day received the same degree of attention. We allude to gas-generator firing for retort-settings; which, like gasholder design, is a solved problem.

It is as well that engineers should think sometimes that all their investigations are not fruitless, nor all their controversies barren. There are enough of those puzzles which seem always to remain without a key, though one be sought never so painfully. With others it is different. Nature herself is an exemplar in this respect. She does not always succeed in improving upon the type. There are organisms living to this day which have seemingly endured from times whereof even geology can but vaguely speak; while many species of living things have altered out of all knowledge. So it is in the Arts. It is impossible to predict offhand which processes or structures will be found amenable to improvement, and which might as well be left alone. Perhaps, as in the case of gas-furnaces and gasholders, appliances that have been left to routine forms for years will be changed at the first touch of a new enthusiasm, and assume new embodiments. On the other hand, fortunes and lives may be spent in vain over endeavours, which seem obviously well founded. But where a technical process or appliance proves susceptible of fresh development, it is only a question of degree how far that process can be usefully carried. It is easy to arrive at the brink of the Infinite by some roads. The wise man recognizes the fact of his arrival, and turns in another direction. This is the reason why there is no more fire in the old ashes of the controversies, once so lively, over gasholder guiding and gas-furnaces.

There is, certainly, no human likelihood of any gas engineer improving upon Mr. Livesey's record for the cost of gas storage, as was realized at East Greenwich in 1890. It would scarcely be fair to constructors nowadays to fling this out-of-the-way figure in their faces, if by so doing they were placed at a relative disadvantage. Mr. Henry Hack, of Birmingham, is one of the best masters of construction in the profession; and, working in a favourable locality, upon a large scale, he has not since been able to attain to Mr. Livesey's figure. Of course, Mr. Livesey knows full well—none better—that uninterrupted progress in one direction is not the rule in gas manufacture. The values of iron, coal, and labour rise and fall from year to year, and between decade and decade; and no man can say that a certain commodity is actually at its cheapest until the time has passed. It is not credited that gas coal will ever be so cheap in England again as it has been. The same with iron. Therefore, it is impossible to look at the price of gasholders, or anything else compounded of several factors, and expect to see the record pointing always in one way. Even the price of gas itself is not amenable to incessant reduction. A balance must be arrived at sooner or later, after which there can be no considerable alteration of prices without a fresh break of the system.

Gas engineers may legitimately take this comfort from Mr. Livesey's talk about gasholders, that the closing years of the past century in England marked the completion of this chapter in technical literature. It is very consoling to have finished something. Carbonizing plant is anything but finished, as might well be understood from the almost angry protests that arose at the recent meeting in regard to Mr. Herring's paper. Mr. Carpenter and Mr. Browne have succeeded in demonstrating that the study of condensation has scarcely begun in accordance with modern gas-works conditions. For a generation at least it has been told by gas managers to one another that gas must be condensed slowly, out of respect for its delicate constitution; and here is Mr. Carpenter, who douches it and chills it in remorseless fashion with no ill effects. Certainly, all these things remain to be pondered over as the "remanets" from the Institution meeting; and they redeem the proceedings from the charge of emptiness. The man who said he would read any book through for the sake of but one pregnant thought or bright idea was wise. One or two real reflections on the actual or prospective state of the gas industry are as much as any member should expect to take home with him from a professional meeting.

The Sons of the Gas Industry.

We do not intend to discontinue yet our championship of the cause of the junior members of the gas profession, and particularly of those among them who aspire for greater opportunities for cultivating knowledge and experience to qualify them not only for the best places in the gas industry, but to fit them, in whatever sphere they may be placed, the better to grapple with the difficulties which spring up with increasing vigour in the path of those who have upon them the responsibilities of the management and engineering work of a gas undertaking. "Take no thought for "the morrow" does not apply to the management or direction of the gas industry. The future demands from all the leaders even as much serious thought as the present. Of little avail will be all the talk of to-day about the quality of the gas that must be supplied in the future, the character of the plant that must be adopted, and the best methods of bringing gas victoriously out of the struggle with its competitors—oil and electricity, both of which are growing in strength day by day—if these matters absorb the interest of the leaders, and blind their eyes to what is of paramount importance, and that is, the liberal provision of incentive opportunity for the young men who are to deal in the future with the condition of things which is now being created. We have not asked for a great deal for the young men of a great industry, whose leaders seem almost to ignore their existence. We have not asked more for them than the heads of the gas profession can afford to give; and we have not asked for more than it is only right they should receive, and not more than the signs of the times demand that they should have.

We are encouraged in our effort by the thrust which Mr. Livesey gave the gas profession during the discussion of the amalgamation question at the meeting of the Institution of Gas Engineers. He questioned the real usefulness of the Institution and of the Gas Institute under present conditions. In this proposal for giving greater scope to the sons of the industry is one way of opening up a new field of usefulness,

and of removing the slur which has been cast upon the professional organizations. We are further encouraged by the letter which appears in our "Correspondence" columns, from Mr. E. J. Wellens, the Hon. Secretary of the Manchester and District Junior Gas Association, the members of which have taken up the matter with commendable energy. They have for the past four years been doing their best to provide for themselves that which the senior bodies could provide, or help to provide, for them much better. They have been successful so far as they have gone, but they want to go further. The pabulum served up at their meetings has been of their own preparation. That is good. But change is also good; and what they feel they want now is the countenance and assistance of elders of the profession. The letter suggests how help may be given. The members of the Association have proved themselves worthy of that help; and if in time the Association becomes affiliated to one of the senior organizations, their effort at mutual improvement will not be lost sight of. The separate existence of this body of young gas men proves their neglect by the leading professional bodies. Copies of the resolution passed by them on March 15 have now been sent to the Gas Institute and Institution; and we hope it will not be recorded that the seniors of the profession of to-day refused help at the request of those who have made a brave and to a point successful endeavour to help themselves. It may be said that the present is an unfortunate time, with amalgamation on the horizon, to ask for this extension of the responsibilities of the leading organizations. It is not. It is a particularly opportune time to try to arouse interest and consideration, in order that, if there is to be a united organization, this may be one of the first branches of new work to which the Association may devote itself; or if, unhappily, there is not to be unity, then one or other of the present organizations can almost immediately turn attention upon it. It will give present satisfaction if the Councils will engage that the younger men—so long neglected—shall have their early care in whatever is to be the representative body or bodies of the future.

We trust that our "Correspondence" columns will yet bear witness to the support in this matter of both senior and junior members of the profession. Even if such support is not forthcoming, we appeal from the high standpoint, that the future of the industry calls for the greatest encouragement in the present of the men who will be appointed ere long to control its destinies.

A Claimant for Honour—and Payment!

When a notable feat has been accomplished which has involved delicate and intricate negotiations, and a nice perception and tact, it not infrequently happens that there are claimants for a share in the honour of the achievement other than the one to whom the honour is first given; and then it is rather a difficult task at times to assess precisely the degree of honour to which they are really entitled. But it is not always so; and we have a case in point. Just before we were going to press last week, we received a letter from a Mr. D. Edwards-Radclyffe, in which he declared that our article on the "Incandescent Mantle Settlement" of the previous week had caused dissatisfaction in the incandescent mantle trade—first because we had given credit for the settlement to Mr. George Livesey, and secondly because there was some doubt as to whether the trade generally would fall into line owing to our "premature publication." It would have given us pleasure, had time permitted, to have disposed of Mr. Radclyffe's letter, so far as we were concerned, in last week's issue; but, nevertheless, in order that the writer of the letter should not be in a position to accuse us of suppressing the information that he desired to publish even for a week, a place was found for the communication in that issue.

We are now very pleased that this course was taken, and that circumstances were against any immediate comment, as there is in our "Correspondence" columns to-day a letter from Mr. George Livesey which throws some little light on Mr. Radclyffe and his doings. It must have been palpable to the meanest intellect that the object of our correspondent last week was not only to remove the suggested dissatisfaction in the incandescent trade, but to set Mr. Edwards-Radclyffe on a pedestal for the admiration of beholders. Now, however, it transpires that his interest in the matter does not stop at a share in the honour for (as Mr. Livesey puts it) "so-called "services" in bringing about the incandescent mantle settlement, but he has claimed a "substantial payment" from the Guarantee Fund! Any ideas which may have been formed by readers as to the disinterestedness and the benevolent motives of our last week's correspondent will be shattered by this. We do not deny (as we have no substantial evidence) that Mr. Radclyffe took steps to bring about agreement between the Welsbach Company and their competitors prior to Mr. Livesey's successful effort; but that he should receive honour or payment for what he unsuccessfully did previous to, and for what he did not do in, the actual settlement is a singular proposition. Just as well, and indeed with far more propriety, might Mr. Livesey, or Mr. James Keith (who rendered admirable assistance in getting evidence), claim monetary compensation for their services and the time occupied.

There are only one or two points about Mr. Radclyffe's letter of last week to which we need refer. He professes to speak for "the incandescent mantle trade" when he states that our recent article caused dissatisfaction. This is rather a sweeping statement to make, because there are certain not unimportant representatives of the incandescent mantle trade who have spoken of the fairness of the article in question. As to the "premature publication" of the information concerning the settlement, Mr. Radclyffe made an unhappy choice of words here. There was nothing "premature" about it, seeing that the Guaranty case had been finally disposed of in the Law Courts more than a week before our article was published. Mr. Radclyffe also declares that he has his doubts as to whether, in consequence of the premature publication, the trade generally will fall into line. We do not know to which particular section of the trade Mr. Radclyffe is here referring; but it is very evident that, at the rate at which they were "falling into "line" before the article appeared, we might—had publication depended upon that grand event—have had to wait until the 1893 patent had run its course before we gave the gas industry the information in our possession. The fact that the dealers or makers whom Mr. Radclyffe has in mind had not "fallen into line" before April 29 simply shows that there was laxity on their part; and we are not going to have the responsibility for that fastened upon us in any way. The gas industry was waiting for information; and it was our duty to supply it as early as possible. If Mr. Radclyffe's friends are slow to move, we cannot afford to follow their example.

The Gas Cure for Petroleum Fires.

The recent fatal fires directly attributable to petroleum lamps have naturally suggested questions in Parliament. The result was disconcerting to those newspaper writers and others who had proclaimed their incapacity to understand why the Board of Trade had delayed taking the precautionary measure relating to the flash-point of burning oil recommended by the Petroleum Committee. Mr. Ritchie said, in answer to his interlocutors, that the matter of the flash-point did not appear to have been the determining factor in these fatalities. The flash-point had been found to vary in every case; and in two instances the oil had one above 100° Fahr., which has been officially adopted by the London County Council as the standard of safety. This authoritative record fully justifies the position always taken in regard to this most important subject in the columns of the "Journal." We have consistently opposed any tinkering at the legal flash-point of kerosene, on the unfounded presumption that by so doing, within the range of commercial possibility, domestic lighting by means of petroleum oils could be made absolutely safe. It has seemed to us that the utmost that could be asserted in this regard is that a high flash-point oil is perhaps safer in some degree, in certain circumstances, than oil of the present legal standard of volatility. But even this contention has nothing positive about it, and is subject to large qualifications. This being so, why upset an enormous trade for a mere fancy?

It has even been objected to us that, in the interest of gas lighting, we ought to approve of everything tending to make oil-lamps dearer in use, which would infallibly happen if the bulk of American kerosene were excluded from the English market. But that argues a narrow view of the matter, which we hope is not our way of dealing with questions of industrial competition. It would be a very poor look-out for gas if its prospects of retaining popular favour depended upon a factitious interference of the Legislature with a competitor. The case for gas as the lighting and heating agent

for the mass of the population of English towns reposes upon a far wider and sounder foundation. It is quite immaterial whether a lamp oil has a flash-point of 73° or 120°; our position is that no such consideration is competent to affect the relative merits of gas and oil as safe, handy, and cheap servants of the great mass of the people. This is a question really for the broadest treatment. The balance of advantage does not turn upon those data which a professor in a laboratory can establish to his own satisfaction. What the public have to think of is the risk of London, Liverpool, Manchester, or any other town, where, at midnight of every day in the week, there are thousands and tens of thousands of oil-lamps containing all the potentialities of death and destruction which incessantly realize themselves with every circumstance of horror.

It is with a view to this state of things that we commend every slot-meter installation in a poor quarter as constituting, among other advantages, a positive reduction of the mass of fire risk which exists among us, scarcely suspected until the worst has happened again. Apart from every other consideration, the obligations of a common humanity should weigh down the balance of policy whensoever it trembles between a restrictive gas sale and the widest attainable popularization of the service. These deadly oil-lamp fires are a fearful price to pay for whatever economical merits the method of lighting from which they arise can show; but they will never be put an end to unless the source of danger is extirpated at the root. The undertaking to remove the origin of the risk may seem a formidable one; but it has already made good progress in many places, and there is no insuperable difficulty in the way of its success in the most unpromising localities—which also are those that most need this help.

The Price of Power Gas in Manchester.

THE proposal of the Manchester Corporation Gas Committee to reduce the price of gas supplied for gas-engines from 2s. 9d. to 2s. per 1000 cubic feet within the city has been approved by the City Council, after a debate and division which had the usual effect of showing that certain town councillors are unteachable in gas matters. Alderman Gibson was apparently only able to carry his point, small as it was in comparison with the magnitude of the city's stake in the gas undertaking, after invoking the spectre of Mond gas, which, he said, had "come to stay." If to Mond gas were added the power gas which Messrs. Crossley, Mr. Wilson, and others, know how to make to equally good purpose, we should heartily endorse the warning. It does not take much to turn the balance of a power user's preference away from coal gas at 2s. per 1000 cubic feet and upwards. Indeed, where there is room to spare in the factory for the gas-producer, ordinary town's gas must be offered for considerably less than 2s. per 1000 cubic feet in order to retain the favour of the purchaser for this purpose. It must not for a moment be overlooked by the proprietary of the statutory gas undertakings that their commodity is not always everything that the power user desires. They not infrequently take the liberty of doing very much as they please with the pressure in the daytime, for main-laying and other objects, including economy, which constitutes a perfect nuisance to him. Every district must be a law to itself in respect of the particular price which power gas should command. In the heart of a Metropolitan district, for instance, where the working of a producer is out of the question, there is no reason at all why the gas manufacturer should not reap the advantage of his position, and get a good price for his gas. In other localities, however, and more especially in the outskirts of many manufacturing towns, it is perfectly arguable that gas for power purposes would have to be sold for 1s. 6d., or even 1s., per 1000 cubic feet to compete with producer gas; and it could be done at the lower rate without loss more often than is generally supposed. In the cognate business of electricity supply, it is a dull concern that does not offer electric power at about one-third of the price of the electric lighting current. Gas undertakings have nowhere been so bold as this, though they might do it with much better reason, and to more certain advantage.

Manchester and Sheffield Comparisons.

Our readers will no doubt remember that, at the meeting of the Sheffield United Gaslight Company about two months ago, Sir Frederick Mappin made some comparisons between his Company and the Manchester and Nottingham Corporation Gas-Works, for the purpose of showing that the Sheffield consumers had good cause to be thankful that the undertaking had not been purchased by the city authorities. It cannot be denied that Sir Frederick made out a strong case; and it is therefore not surprising to find that, at last week's meeting of the Manchester City Council, the attention of the Chairman of the Gas Committee (Alderman Gibson) was called to the matter. Alderman Gibson contended that the real test of comparison between one gas undertaking and another did not consist in picking out a few items, or in the price charged for gas. This is, of course, true so far as the management is concerned; and, inasmuch as no two places are situated precisely alike, an exact comparison is out of the question. From the consumer's point of view, however, the price charged for the gas is a very real test of comparison indeed. Manchester is evidently seriously handicapped in several respects; but against this there is to be set the very much larger consumption there than at Sheffield, which may explain the difference in favour of the former city in the cost of manufacture, distribution, &c. Manchester supplies 19-candle gas, which Alderman Gibson says costs (at 2d. per candle) 4d. per 1000 cubic feet more than the 17-candle gas sent out at Sheffield. It is to be hoped that the consumers think the extra 2 candles are worth this outlay, and that they will keep well in mind the first step that must be taken when they desire to get down somewhere nearer to the Sheffield prices. While admitting that Alderman Gibson has offered a fair explanation of the differences which exist between the two undertakings, it is impossible not to feel sorry for the Manchester gas consumer, who not only has to pay 9d. per 1000 cubic feet more for his gas, but (in spite of the contribution annually handed over by the department) also has to pay heavier rates, than his more fortunate brother at Sheffield. "Let well alone" is a maxim that may be earnestly commended to the ratepayers of the latter city with regard to the question of the ownership of the gas-works.

An Excellent Example.

The expenses involved in arriving at the price at which the undertaking of any particular gas or water company should be transferred to the public authorities of the place supplied are usually so heavy that, in the case of small concerns at least, they frequently constitute a serious hardship. When the undertaking to be purchased is a large one, these expenses may not be of much moment; but the cost of transfer does not generally diminish in proportion when the works of the smaller companies are in question. We therefore welcome a most excellent example in this respect, which, though it refers to a water company, would be just as easy to follow in the case of a gas undertaking. From an account appearing elsewhere, it will be seen that the Water Committee of the Shepton Mallet District Council (with a view to avoiding heavy law costs) have presented a report in which they recommend that a request be made to the Water Company to submit an offer upon terms they lay down. These terms are that the Company shall name a water engineer (to be approved by the Council) who shall act as sole arbitrator between the parties in arriving at the value of the undertaking, and that an accountant shall be appointed by the Company to prepare a financial statement for the engineer selected. The amount fixed by the engineer is to be the price at which the Company shall offer their undertaking to the Council; and the Council are then to have three months in which to accept or refuse the offer. The rules regulating the procedure before the engineer, submission of evidence, &c., are to be drawn up and approved by both parties. Of course, various other conditions are included; but this is the gist of the suggested arrangement. Altogether, the proposal appears to be a thoroughly businesslike one, and well worthy of adoption in other cases—where the local authority are really in earnest over the question of purchase. We shall await with considerable interest the outcome of this praiseworthy effort to get rid, as far as possible, of the cumbersome and costly methods that have hitherto prevailed.

A Suggested Diluent for Acetylene.

A paper contributed last week to the London Section of the Society of Chemical Industry, by Mr. J. S. Brame and Professor Lewes, contained some interesting information with regard to the attempted production of a mixed

carbide of manganese and calcium, for the purpose of generating a mixture of marsh gas, hydrogen, and acetylene. Manganese carbide yields a mixture of equal volumes of marsh gas and hydrogen, which are not formed from the calcium compound; and it would therefore prove a good diluent for acetylene, so as to enable it to be burnt without smoke or any deposit. This gave rise to the idea either of mixing the carbides before generation of the gas, or of producing a mixed carbide which on decomposition would yield the various gases in suitable proportions. In their paper, the authors described their efforts to produce such a mixed carbide. The proportions of lime, manganese dioxide, and coke were varied for the different tests; but it appeared that, when the proportion of manganese dioxide to lime was low, only calcium carbide was produced, and when the manganese dioxide was in considerable excess only manganese carbide was obtained. Under neither of these conditions, therefore, was a mixed carbide formed. Though there does not thus at present seem to be any advantage in mixing manganese dioxide with lime for carbide manufacture, it was explained that intermediate mixtures of the raw materials have not yet been tried on a large scale. A fact which was not brought out by the authors was that the mixed gases yielded by manganese carbide either would serve well for lighting by means of Welsbach mantles, or could be readily converted, by carburetting with the vapour of carburine, or, preferably, of benzol, into good illuminating gas. Probably at current prices benzol would prove cheaper than acetylene as an enriching agent for these gases. It remains to be seen, however, at what price manganese carbide can be sold. It will not prove of much commercial utility unless it is considerably cheaper than calcium carbide.

The Selection of Officials for Appointments.

The efficiency of the machinery for the selection of men for responsible posts in the industrial or business world is often discussed. From sheer favouritism down to unintelligent chance selection, every conceivable shade of practice in this regard has been in vogue at different times and places, with the most varied results. This is a subject of particular interest for followers of the gas industry, who, in common with other members of the official class, have from time to time to run the gauntlet of competition for an appointment. Over and over again, the most careful process of selection has resulted in the preferment of the worst of all the candidates, which is as much as to say the best men are far from always winning. Men of the official classes who accept this risk as part of the conditions of their life, are usually careful to provide themselves with a sufficiency of stock credentials in the shape of "qualifications," degrees, membership of close professional organizations, and so forth. The difficulty of avoiding miscarriages in the selection of holders of important appointments, however, is not lessened by the general recourse to these expedients. It is always getting shifted farther back. So much is this so, that upon the constitution of the committee of selection rather than upon the qualifications of the candidates is success or failure in the choice held to depend. The point has been shaved down almost ludicrously fine in connection with the selection of the architect for an important building proposed to be put up in the North of England. Open competition by drawings being ruled out of the question, a limited number of approved architects are to be asked to submit sketches. The selection of these gentlemen is to be confided to a small committee of experts; and thereupon the professional journals declare that the whole issue hangs upon the choice of these experts. How much farther back should the chain of responsibility be traced? After this, the ordinary painful selection of a gas manager strikes one as haphazard in the extreme.

The Metric System.

The report of the National Association of Manufacturers in the United States upon the advisability of Congress taking any steps towards the adoption of the metric system is not likely to commend itself to the fervid advocates of the adoption of that system who are, as the Committee of the Associated Chambers of Commerce declare themselves to be, of opinion that the Government should be urged to make the adoption of the metric system compulsory, "leaving matters of detail to be considered later." A pious but scarcely useful opinion, coming from the representatives of a body which should be the first to consider such a proposal in all its details. It is so much easier to generalize about the utility of the metric system than to show in detail how its application is to be made universal, that the Government have rightly taken no notice of such a representation. The United States manufacturers report that the compulsory adoption of the metric system would probably affect the manufacturing interests in that country as follows: "One-third who are exporters to European countries and their dependencies would be benefited; one-third who do business in this country (the States) and all other countries would neither be benefited nor greatly injured; and one-third who do business in this country and in England and dependencies would be seriously injured. For all this the expense and inconvenience would be very great. In view of these conditions, and the further fact that the metric system is already legalized for the use of those who find it profitable, this Association recommends that no further action be taken on the matter at this time by Congress." Those who have "considered details" in reference to the adoption of the system in this country, will agree rather with the United States manufacturers than with Chambers of Commerce who wish to have first and try afterwards.

Progress at Southampton.

The address delivered by the Chairman of the Southampton Gas Company (Dr. T. W. Trend, J.P.), when moving the adoption of the report and accounts at the half-yearly meeting last Wednesday, will be of interest to a larger number of proprietors of gas undertakings than those to whom it was addressed. Timid shareholders are apt to take alarm at the introduction of electric lighting, and are sometimes so ill-advised as to hastily part, at a sacrifice, through their nervousness, with property which has not lost one jot of its value. People of this temperament should take courage from Dr. Trend's interesting comparison of the gas supply at Southampton in 1892, when the electric lighting works were established, with that of last year. In round figures, it has gone up 200 millions, or about 63 per cent., in the ten years. Unfortunately, the increased cost of the coal and oil, the reduced returns from residuals, and the practical duplication of the rates, prevented the Company from making any reduction in the price of gas; but 2d. per 1000 cubic feet has been taken off as from the Lady-day quarter. The use of gas for other than lighting purposes is extending day by day; and this concession will stimulate it. The prosperity of the undertaking shown by the figures given above is not likely to fall off while the present Directors and their able staff retain control over it.

In Argentina.

Just recently we drew attention to the remarkable energy displayed by the River Plate Gas Company in cultivating business under the stress of difficulties of a character unencountered in this country in the present age. Not only do they have to meet the competition of the electric light, and bear with fortitude the studied and forced economy on the part of consumers in times of trade depression, but there is the competition in Buenos Ayres between three strong Gas Companies, capitalized from this country, and with their administrative centres in London. One of the competitors of the River Plate Company is the Buenos Ayres (New) Gas Company; and it will be found in the report of the meeting of the shareholders published this week that what we said of the former concern is equally true of the latter. The accounts reveal a condition of affairs which tell of skilful local management and ardent effort in keeping the concern ploughing forward through the difficulties pressing on all sides. Last year was a bad one for most commercial enterprises in Argentina; but the Buenos Ayres Company, notwithstanding electric and gas competition, showed a balance gain of 1093 meters. But when we view this large addition, and then find that the increase in the consumption of gas was only $1\frac{3}{4}$ million cubic feet over the year—well, we can realize better than before what trade depression and political unrest mean for these concerns. There is another instructive feature found in the tale told by the Chairman (Mr. F. J. Heseltine) as to the Company's operations during the year. It is a curious fact that, although the consumption of gas only increased by $1\frac{3}{4}$ million cubic feet, the profits were £10,500 more than for 1900; and this permitted the payment of a dividend of 7 per cent. as against 6 per cent., and the carrying over of upwards of £5000 more than the previous year. Looking for a reason for this prosperity, we find it was due to three circumstances—"in great measure"

to the economies in the cost of production, to the cordial working of the staff, and to the favourable year for residuals. The Chairman put the economies in production in the forefront; and we almost wish, for interest's sake, that he had particularized what those economies were. The Company have adopted inclined retorts and a carburetted water-gas plant; and it would have been rather instructive to have learnt whether these have played any important part in the economical working. As to the residuals, the importation of coke has been stopped; and this has created an easy market for that product. What a glorious time many gas companies here would have if the importation of coke into their districts could be prevented? These are features about the working of the Buenos Ayres Company which carry their lessons for gas administrators.

WATER AFFAIRS.

The Progress of the Water Inquiry.

THE proceedings of the Joint Parliamentary Committee on the London Water Bill last week were not marked by any "surprise" decision such as that which astounded everybody at the close of the seventh day of the inquiry. The following day's business was comparatively tame; and then came the adjournment, which allowed time for considering the situation. It was certainly a peculiar one. A Committee, composed mainly of supporters of the Ministry, to whom had been entrusted the duty of examining the details of a measure emanating from a Government Department, had considered it to be within the terms of the reference to them to order the excision of the very feature which its framers thought would ensure its acceptance. It was scarcely to be expected that the promoters of the Bill would consent quietly to such mutilation; and though towards the end of the week there were rumours of a desire on the part of the President of the Local Government Board to meet the views of the Committee, it was not expressed by the representative of the Department in the remarks he made on the resumption of the inquiry last Tuesday morning. On the contrary, he had to inform them that their decision had been received by the Government—not, as he was careful to explain, by the Department merely—with profound regret; and all he could do, under the circumstances, was to call their attention to the fact that the Board which they suggested as a substitute for the one provided for in the Bill was not in accordance with the general scheme of the Government, inasmuch as it did not give representation to the sanitary authorities in the area covered. No doubt the prospect of having such representation ensured a good deal of support for the Bill; and, as Mr. Fitzgerald took pains to point out, no intimation had been given of the possibility of its being withheld. The inclusion of these bodies in the schedule setting out in detail the constitution of the Board was a clear recognition that they had some right to be there; and before they were summarily excluded they should at least have been allowed to justify, if necessary, the position accorded to them. The learned Counsel appealed to the Committee to reconsider their decision, and allow the representatives of the Metropolitan Boroughs to be heard. He was strongly supported by Mr. Blennerhassett on behalf of the City of Westminster. The Committee were evidently impressed with the justice of the appeal; for they decided to receive evidence as to the constitution of the Board.

This point gained, the remainder of the two sittings last week was mainly occupied in the examination of witnesses in support of the scheme of the Government. A meeting of Mayors was held on Monday, at which a resolution was passed protesting against the course taken by the Committee in excluding the Metropolitan Boroughs and the District Councils; and their views on the question of their right to the representation given to them in the Bill were laid before the Committee by the Mayor of Islington (Mr. W. J. Crump) and others. Speaking for the largest borough in London in point of population, he made it quite clear to the Committee that the feeling there—and it might be taken as typical of the other boroughs—was that the London County Council had very little to do with the water question, which was really one for the Borough Councils, as the health authorities. Of course, the magnates of Spring Gardens regard these new bodies as little, if any, better than the superseded Vestries. But Mr. Crump assured the Committee, from his knowledge of the *personnel* of the Councils, that the members were quite as capable of doing good practical work as were those of the County Council. The "poro-" chial" element of Bumble's days has gone for ever. The Mayor of Westminster (Colonel Probyn) next urged the unreasonableness of excluding such a borough as his from representation; and he was backed up by many others, including the City of London. Before the Committee rose on Tuesday, Mr. Wedderburn addressed them in advocacy of the claims put forward by the Kent Authorities for severance, and for the constitution of a separate Water Board. He contended that if the areas he represented did not adjoin the County of London, those who controlled them could become possessors of the water undertaking lying in their district. All the sources of supply were within their own area; and they wished to avoid depletion of their streams for the benefit of outsiders. The Committee declined to allow the claim put forward for the insertion of a severance clause in the Bill, but they specified that their decision was not to prejudice any future application by Kent to Parliament after the formation of the Board.

On Wednesday, the first witness called was Sir John Aird, Bart., the Mayor of Paddington, who urged the necessity for having members of the Borough Councils upon the new Board, for the reason that they would be cognizant of the requirements of the different districts. Other Mayors and representatives of Urban District Councils supported this view. Alderman Redman, however, the Mayor of Southwark, said his Council considered that the London County Council should be the controlling authority, though, of course, they would prefer a body directly elected for water purposes. The Mayor of Fulham (Mr. Davies) and other witnesses were of this opinion. Mr. M'Kinnon Wood was recalled, and urged that the constitution of the Board should be on the county basis, and that the County Council should have a majority upon it. Mr. Balfour Browne then addressed the Committee in support of the Council's case, and they had a short deliberation. In the result, Lord Balfour announced that they had not had sufficient time to come to a definite decision as to the admission of representatives of the Metropolitan Boroughs and the Urban District Councils upon the Board, and therefore they would adjourn till Monday. On re-assembling yesterday, the Committee had a long deliberation in private, at the close of which the Chairman announced that, by an equality of votes, a motion to adhere to the resolution passed on the 30th of April, reducing the number of the proposed Board, had been negatived, in accordance with the rules of the House, and that the Bill would stand as submitted to the Committee.

Prevention of River Pollution.

In view of the extent to which rivers and streams are drawn upon for the supply of the public with water, no effort should be neglected for preventing their pollution by the discharge thereinto of noxious matter. Much good has, no doubt, resulted from the passing of the Rivers Pollution Prevention Acts; but nevertheless we are assured by one who is justly regarded as an authority on water supply that "nearly every stream of any size in this country is befouled." How far this statement accurately represents the present condition of our principal watercourses we are not prepared to say. At any rate, there is a prevalent feeling that the above-named Acts require amendment, in order that stricter supervision may be exercised. A Bill has accordingly been introduced by Sir Francis Powell—who, as a member of the Sanitary Commission, has doubtless been impressed with the necessity for the step—to extend to County Councils, Joint Committees, and Rivers Boards the main provisions of the Mersey and Irwell Act of 1892 and the West Riding of Yorkshire Rivers Act of 1894. Every person who permits sewage matter to fall into a stream, is to be deemed to have committed an offence under the Act; but where, before entering the stream, it passes through a channel vested in a sanitary authority, that body are to be chargeable with the offence. Sections 2, 3, and 5 of the Rivers Pollution Prevention Act, 1876, and the entire Act of 1893, are to be repealed as regards England. with certain exceptions. It is proposed that a local authority should be empowered to contribute to the expenses of a prosecution by another authority, and the Local Government Board to order, in certain cases, the rating of areas specially benefited.

INSTITUTION OF GAS ENGINEERS.

PROCEEDINGS AT THE GENERAL MEETING,

HELD AT THE

INSTITUTION OF CIVIL ENGINEERS,

APRIL 30 AND MAY 1, 1902.

Mr. THOMAS HOLGATE, M.Inst.C.E., of Halifax, President.

PAPERS READ

(*Concluded from p.* 1195).

UNIFICATION IN THE METHODS OF STATING THE ITEMS COMPRISING THE CARBONIZING COSTS IN GAS-WORKS.

By W. R. HERRING, of Edinburgh.

Statistical research is always instructive. It becomes an imperative necessity when the relative merits of two distinct methods of accomplishing the same purpose are to be ascertained. To be of any utility, however, a uniform basis of comparison must first be determined, so as to ensure the accuracy of the subsequent conclusions that may be founded upon any particular statistical investigation.

In fulfilment of a pledge addressed to the "JOURNAL OF GAS LIGHTING" on the 5th of December last, in which the author responded to the Editor's suggestion to "initiate a step to frame a definite list of items which would comprehend the various costs of the inclined retort system," and at the suggestion of your President, he is bringing before your notice to-day the urgent necessity for determining some common basis on which items affecting the manufacturing labour costs of the production of gas shall be stated.

The extensive adoption of mechanical appliances in the manufacture of gas has rendered former methods of stating costs almost, if not quite, obsolete. Neither is the old basis of stating the capital per ton of coal carbonized a criterion as to the efficiency of a gas-works administration. For many years past, both for humanitarian and financial reasons, the one aim and object has been to reduce the labour involved in the operations; and there are not a few who are prepared to strongly advocate the introduction of mechanical means to do the work even at the same cost (after allowing for interest and depreciation, and wear and tear charges) as formerly by hand labour. In the majority of cases, however, considerable economy can be attained by adopting mechanical means for the purposes in view; but it is inconsistent to maintain a low capital ratio per ton of coal carbonized and at the same time secure the minimum figure of manufacturing costs so far as wages alone are concerned.

The gas-works of the future must be judged on the basis of the initial manufacturing costs for labour throughout the works per ton of coal carbonized, which item may be subdivided to the greatest possible extent. In order to overcome any inequalities as regards rates of wages and hours worked in various towns, the unit of tons per man per hour should be adopted.

The author does not wish it to be understood that he pays no regard whatever to the fact that every £100 of capital expended involves an annual burden for interest and sinking fund charges, and repairs and maintenance, equal to about 6 per cent. per annum; but seeing that the abolition of the labour of one man at £60 per annum will pay 6 per cent. per annum on a capital expenditure of £1000, there is not much fear of the capital involved in the introduction of labour-saving appliances exceeding the profitable limit. In other words, we may be called upon to pay a larger sum of money for interest on capital per unit of gas made; but this will be more than counterbalanced by the lesser cost in the manufacturing wages as between mechanical and hand work.

The many new methods and appliances that have been introduced into gas-works within a comparatively recent period of time have rendered a comparison between different works almost impossible. There are many clear instances on record of comparisons with the same works before and after the application of these modern methods, which have afforded valuable information in themselves; but of late there appears to have been considerable doubt expressed, particularly by those who have not had the advantage of experience with all the systems of carbonizing, as to the relative efficiencies of one system and the other. This doubt is all the more remarkable when we bear in mind the fact that on the Continent of Europe no doubt whatever prevails as to the superiority of the inclined retort system. American *confrères* have come to the same conclusion.

There is certainly no doubt whatever, in the minds of those who have had a lengthened experience with all systems of carbonizing in this country, as to the superiority of inclined retorts on all points—comprising capital expenditure, working costs, and efficient maintenance—as compared with any other system. For some British gas engineers, therefore, to be engaged in a controversy as to the relative merits of the inclined retort system and the next best method—viz., horizontal stoking machinery—is another instance of how difficult it must be for Continental people to understand the British reasoning capacity.

It does not appear to the author to be an impossible task to bring about such uniformity in the methods of stating these figures as will enable any engineer to analyze them for himself, and determine what is the best system for his own particular conditions, wherever he may be at the time. To accomplish it, however, we must be prepared to state the facts frankly and openly in relation to our respective works—not necessarily for publication, but for classification in some common form, from which subsectional analyses may be abstracted, and a common statement rendered applicable to all circumstances and localities.

In the first place, variations in the rates of wages are a disturbing element; therefore let it be stated in the weight of coal handled per man or per hundred men. Secondly, the duration of hours actually worked per man per day. In the third place, the author submits that the inquiry should cover every item in the cost of manipulating a ton of coal, from its reception in railway waggons, or boats or ships, to the discharge of the coke into the yard, or loaded into carts and waggons: every item, however incidental and trivial in itself, being duly taken note of, but kept distinctly separate, so that in the case of localities where some of the operations are not required, due allowance can be made for this when making the comparison with other systems.

Without some definite and perhaps elaborate statistical investigation, it is absolutely impossible for business men to ascertain the relative values of the various plants they employ for carrying on a common process. It may be necessary to extend the comparison over a long period of time; but it is only by a compilation of such facts that the efficiencies and deficiencies of the various systems will be made manifest.

The capital expenditure involved in constructional works must not be lost sight of; but too great a cry has been raised for low capital units, with a total disregard of the extravagant manufacturing costs which the policy of unduly curbing the capital expenditure has resulted in. The gospel of keeping the capital low has been misunderstood by many. It is the earning capacity of the capital that should be most carefully ascertained, and not the initial outlay on any particular plant. To compare the relative capital costs of the various systems of carbonizing plant is perhaps an equally difficult task, although by no means impossible.

The author has always deprecated the practice of throwing figures comprising total costs, more or less subdivided, of constructional work, such as we sometimes listen to in connection with the meetings of our Technical Associations. The figures are only of academical interest. It is quite useless comparing the total cost of a certain works in London with a works where fire-bricks and iron lie just over the boundary wall. The author's bricks in Edinburgh, for instance, have cost him less than 55s. per 1000—a brick fully equal to the best Stourbridge brick—whereas probably the same brick in the South of England costs 75s. per 1000. How can one compare costs on such a basis? The same with regard to structional ironwork—rates vary up and down the country. The price of raw materials can more than double itself in the course of a few years. The circular girder roof erected over the retort-house at Huddersfield in 1894 cost at the rate of £12 per ton. An exactly similar roof erected over the retort-house at Granton in 1899 cost £16 per ton. Similar work a little later rose to as high as £19 10s. per ton, simply owing to the rates of raw materials and wages varying in the meantime.

The individual ideas of structural stability also have a very important influence upon the structural cost. One

man may pay much greater regard to the subsequent repairs and maintenance of a plant, and be prepared to spend more money to minimize this in the first instance, while others will disregard the subsequent upkeep for the sake of a cheap initial job. One man will put in 2-feet division walls between his settings; another will have 18-inch and even 14-inch work. One will leave huge cavities within his settings and furnaces; another prefers to build them solid. One may have many division walls supporting the retorts, and another fewer in the retort-settings.

Under such varying circumstances, the quantity sheets must be of supreme importance. They will in the first instance give a true comparison of the actual quantity of the various materials employed in the construction of any particular plant, and thus enable the merits of the design to be better ascertained. Succeeding this, it may be necessary to make some adjustment as between one design and another, wherein one may have made better provision against wear and tear while the other has not, or one provided for subsidiary things to bring about labour economy which are omitted in another. The sheets adjusted, common rates must be applied to each, and the final conclusions arrived at after ascertaining the labour economy of the two designs. Any expenditure on the construction of the work is justified if an adequate return is assured.

The compilation and comparison of the working costs in the minutest detail alone will enable us to determine exactly the value, not only of the plant as a whole, but of the subdivided parts of the plant, and will clearly show how far it is commercially profitable to spend money on the various devices. This suggestion is therefore brought before your attention to-day as an urgent necessity of our time; and it is to be hoped that, after hearing the views of the members present, some tangible steps will be initiated to accomplish this all-important object.

At the conclusion of his paper,

Mr. HERRING said that, in order to bring the matter into something like form, he had drafted a resolution which, in the first instance, suggested the co-operation of the Gas Institute in the form of a Committee. But they knew that Committees were slow to work—there were difficulties in arranging meetings, and so on; and the larger the Committee the greater the difficulty was. Therefore his proposal was merely to appoint a small Committee, who should determine the headings under which the various charges in connection with the manipulation of a ton of coal into gas and coke should be placed. It only required at present to formulate those headings; and he thought perhaps a small Committee of the Institution would get to work much socner, and produce a more tangible result, than if a large Committee were appointed who might not report for a twelvemonth.

Discussion.

The PRESIDENT thought it would be a convenient course to first discuss the paper which had been read, and then come to the question of the proposed resolution. If that were passed, they could select the names of gentlemen to act on the Committee.

Mr. F. W. CROSS (Leyton) thought the resolution could not altogether be separated from the paper, for it must have occurred to anyone listening to the paper that some step of this nature was bound to arise out of it, to render it of any utility. Mr. Herring, by bringing forward the resolution, had, in a sense, taken the words out of his mouth; for he was going to suggest the same thing, and no doubt it had occurred to many others. The differences of the working of various engineers was so great that no one engineer could formulate a scheme upon which the unit could be determined. A short time ago, before seeing any announcement of this paper, he had occasion to look up some figures comprising the manufacturing wages of various companies and corporations, as compiled from their balance-sheets; and it was very surprising to find the great differences between the several works. Of course, in the matter of coal the expenditure must necessarily vary; but on other points the differences were very remarkable—such as purification, salaries, wages, and repairs, all coming now under the head of manufacture. As regards purification, the lowest charge per 1000 cubic feet was 0·15d., and the highest 1·426d.; in salaries, the lowest was 0·131d., and the highest 1·395d.; in wages, the lowest was 1·982d., and the highest 5·941d.; for repairs to works, the lowest was 1·402d., and the highest 4·893d. The divergence of these figures was remarkable; and without some system such as was suggested by Mr. Herring for classifying the various details comprised in these items, it was impossible to make any fair comparison of one gas-works with another. He therefore thought the appointment of a Committee would be the proper course to adopt. One point occurred to him with regard to the paper itself, and that was as to the ton unit being adopted. Well, that was a question of what they got out of a ton, and how they worked their ton of coal, because different engineers worked their coal in a different manner. One might work with light charges, another with heavy charges; and the first one might be handicapped as against the man working with heavier charges by the use of the tonnage unit. Again, taking the question of leakage per 1000 cubic feet sold. The man having heavy leakage, from circumstances which might be beyond his control, would be in quite a different position to the man with a very small percentage of leakage. There were so many items to be considered that it was, of course, impossible to bring them all forward. He appreciated the fact that Mr. Herring in his paper referred more particularly to inclined retorts; but he did not think he could attempt to separate them in the whole general system, particularly where carburetted water gas was brought in as an element. He agreed with the author generally as to expenditure on capital, as to which many comparisons might be made. This was very well put in the paper; but he thought they could only take it with the explanation given by Mr. Jones on the previous day—that it was a sign-post pointing which way they should go.

Mr. CHARLES HUNT (Birmingham) said it was a matter of some difficulty to discuss this paper at any length with advantage. The essence of it was the suggestion that a Committee be appointed with the object of prescribing a form for the statement of working costs. He understood the author's idea to be that this form should be used simply when any question of comparison arose in the discussion of various systems, because, of course, the Gas-Works Clauses Act of 1871 prescribed the method in which the accounts of the different undertakings should be stated; and there was no difficulty in ascertaining the difference in the various items of cost between one undertaking and another. But for the purpose of comparing different systems, the proposal would undoubtedly ensure some advantage; and he was prepared to support Mr. Herring's proposal, subject to the amendment that the matter be referred to the Council to consider, and appoint a Committee—not necessarily of their own members—if, in their opinion, it were thought desirable, for the purpose of devising a plan as proposed. If Mr. Herring would accept this amendment, he would second it.

Mr. HERRING intimated that he was quite ready to accept the amendment.

The PRESIDENT said that, as there seemed no desire to prolong the discussion, he would put the resolution as amended.

The resolution was then carried unanimously.

Mr. HERRING said that, since the issue of the discussion had been simply to refer it back to the Council, it was hardly necessary to deal very seriously with Mr. Cross's remarks. The statement he made with regard to the great variations in the cost of wages in different works, simply emphasized the necessity for ascertaining why one works could manufacture very much cheaper than another. If it was mechanical devices which assisted it to do so, the sooner they had the fullest information about these devices the better. If it was a matter of the general arrangement of the works, the sooner these merits were discovered the better. It would also act as a guide in dealing with similar work in future. The ton unit must, he thought, be the basis of comparison. He might be using a ton of coal which would give 12,500 cubic feet, or one which would give only 8000 cubic feet; but he paid for working a ton in wages and in carriage, and in all the manipulation, because it occupied practically the same bulk. Therefore he thought he must stick to the ton as a basis, and then ascertain what wages were incurred in manipulating this definite quantity and known weight—no matter what the product was. The same with regard to the coke. The volume or bulk of coke per ton of coal was pretty much the same, it did not vary more than 2 cwt.; but the value was a very different thing. If he departed from the fixed basis of a ton actually paid for and handled, he would immediately get into a wilderness of figures, and never be able to arrive at any definite conclusion. The same remarks would apply to the question of

leakage. He hoped the Council would deal vigorously with this matter, because he felt that they were often talking about this, that, and the other thing not being a success, or being a success in one place and not in another; but they never arrived any nearer to the facts as to which was really the best system. There was, in the minds of those who had large experience of all systems, no doubt as to which was the best; but the only way to satisfy everybody was to get these statements classified, and arrive at the bottom facts.

Mr. H. E. JONES (London) hoped it would not be understood that this Committee were going to be limited to the ton unit, without regard to whether a ton of the same coal in two different works should not give the same results.

The PRESIDENT said he took it that all this would be considered by the Committee.

Mr. R. O. PATERSON (Cheltenham) said he thought the President had closed the discussion rather suddenly. He entirely agreed with the proposal to refer the matter to the Council; but he hoped it would not be understood that, in doing so, for the purpose of formulating some scheme or appointing a Committee, the meeting were committed to all the consequences of accepting the statements or expressions of opinion to be found in the paper. He, for one, should certainly object to be saddled with the responsibility of such a paragraph as that relating to the superiority of inclined retorts on all points. He declined to accept that. They had had no opportunity of calling in question any statement made by the author; neither had he put before them any proof of his assertions.

Mr. A. WILSON (Glasgow) remarked that there were a few other points in the paper which were worth discussion.

The PRESIDENT said he was sorry gentlemen did not rise more quickly when the opportunity was afforded them. The essence of the paper, at any rate, was the desirability of appointing a Committee to formulate a scheme; perhaps the other matters might be looked upon more as side-issues.

Mr. WILSON said he should not like it to go out to the world that they all agreed with this paper.

As mentioned in our summary of the proceedings last week, we have received the following letter on the subject of the paper from Mr. Alexander Wilson, of the Dawsholm (Glasgow) Gas-Works.

To the Editor of the "JOURNAL OF GAS LIGHTING."

SIR,—Owing to the rather abrupt closing of the discussion on Mr. Herring's paper, many members were deprived of the opportunity of calling in question several of the statements made therein. With the view of showing that all the members do not accept these statements, I have to ask you to add this letter to the discussion.

With the main object of the paper, and also with the resolution passed, I have no doubt most members are in accord. Whatever system of tabulating costs be adopted, the system which enables us best—with a reasonable amount of trouble—to put our finger on the weak or costly items of our work, must receive a favourable reception. I should think, however, that at this time of day few, if any, large concerns are run on the old rule-of-thumb lines, but all have regular systems of getting out costs, to enable the responsible heads to arrive at the best and cheapest methods of doing the work.

The writer of the paper might have increased our debt to him if, in addition to bringing the subject before the Institution, he had formulated some system of tabulating costs superior to those generally in use, and enabled those managers who have adopted inclines to show results which will please and encourage others who have laid out much capital on inclined-retort installations; for that no doubt is one of the main reasons for all this anxiety about costs at this time. Those who have kept their faith in the horizontals with machinery, know exactly the position of affairs; but when people have to "whistle to keep their courage up," it is a little unsettling when all the band does not play the same tune.

If the stated object of the paper had been adhered to, little could have been said; but the author has also written a eulogy on inclined retorts, and states practically that carbonizing by inclines is *the one and only system*, and all other methods of carbonizing are simply nowhere. He gives no data in support of this statement, but proves it to his own satisfaction by telling us that it is only those who have no experience who doubt his word. The gas engineers of the Continent, America, and Granton have come to this conclusion, so all gas engineers must forthwith pull out their horizontals and build inclines.

Although most of us only claim to possess "Ordinary British reasoning capacities," I venture to think this method of reasoning will not convert many to inclines, to the exclusion of all other methods of carbonizing. No doubt there are works where inclines will suit the purpose and do the work well, under certain conditions. But the contrary also holds good; and not only on the score of cost, but for a variety of weighty reasons, it has yet to be proved that carbonizing by inclined retorts is *the* best system. There are engineers who have had good experience with inclines, who are making their extensions with horizontal retorts and stoking machinery. Also the engineer of one of the largest gas-works on the Continent assured me not long ago that he was now not at all in favour of inclines.

In the matter of capital, if the author of the paper has carried his theory into practice, he or some successor will have heavy burdens to bear in the future; for he seems to have forgotten that each man employed at gas manufacture is only effectively employed less than half the year, while the capital accounts, &c., run on for the full period.

Many other points might be taken up; but perhaps sufficient has been said to show that, while we do not disagree with the resolution passed, the remainder of the paper is only an expression of opinion unsupported by either facts or figures.

ALEXANDER WILSON.

Dawsholm Gas-Works, Glasgow,
May 1, 1902.

COAL GAS CONDENSATION: A THEORY.

By A. F. BROWNE, of Vauxhall.

Six years ago, the author, at a meeting of the Southern District Association, expressed an opinion that the subject of condensation would repay further investigation. Unfortunately for himself, he did not follow up the inquiry until, by Mr. Charles Carpenter's courtesy, it was his good fortune to be associated with, and perhaps mainly responsible for, an investigation of the theory of the subject in connection with Mr. Carpenter's paper upon the Bankside condenser, read last autumn before the Southern Association.*

The inquiry brought to light facts which were, perhaps, not generally known, since they are not found in current treatises, and which, in the writer's opinion, are of sufficient importance to be brought before this Institution; and this must be his excuse for offering a paper upon the subject at the invitation of the President to contribute something to this year's Transactions.

It is evident that a theory of condensation must be based upon consideration of analysis, specific gravities, specific heats, and physical conditions. These data being ascertained for a given quantity of gas, the work of the condenser in cooling such gas through a given number of degrees can be calculated in British thermal units.

Analyses, by well-known experts, of coal gas as supplied to the consumer are not far to seek; but condensation is mainly concerned with unpurified gas, of which the physics are rather more obscure. Here it was that the author, and those working with him—Messrs. R. Collins, John Holland (unhappily since deceased), and B. Browne, to all of whom his obligation is great, for without their technical knowledge and ability these problems would not have been mastered—were led to conclusions so startling that they hesitated to make them public.

The results of the investigation are stated in Table A, of which it may be said that, while it only claims to be approximately correct, it understates rather than over-estimates the duty required in condensing from 140° down to 60° Fahr., a volume of crude gas which, when cooled and purified, measures 2 million cubic feet at 30 inches and 60°. The table shows that 87 per cent. of the total work of condensing this volume is expended upon aqueous vapour, and 13 per cent. upon the permanent gases and other vapours; therefore, if aqueous vapour were absent, the cooling of the gas would be a bagatelle.

But the vapour of water is not the only vapour which coal gas carries; more often than not, may we say it is saturated, as it leaves the retort, with naphthalene vapour. Hence it

* See "JOURNAL," Vol. LXXVIII., p. 1306; and *ante*, p. 628.

TABLE A.—*Estimate of Heat Units to be Removed from a Volume of Crude Gas Measuring (after Condensation and Purification) 2,000,000 Cubic Feet at 30 Inches Bar. and 60° Fahr.*

Gases or Vapours.	Volumes at 60° Fahr. and 30 in. Bar.	Volumes at 140° Fahr. and 30 in. Bar.	Specific Gravity at 60° Fahr. Air = 1.	Specific Gravity at 140° Fahr. Air = 1.	Weights of Gases or Vapours.	Specific Heats. Water = 1.	B T. U. to be Removed.
	Cubic Feet.	Cubic Feet.			Pounds.		
Purified gas (dry)	1,965,260	2,267,027	0·373	·3233	56,151	·743	3,337,615
Co_2 (impurities to be added)	24,200		1·529	..	2,834	·216	48,970
NH_3 ,, ,, ,,	16,000		0·589	..	722	·508	29,300
HS ,, ,, ,,	14,400	65,300	1·191	..	1,313	·243	25,520
CN ,, ,, ,,	1,500		1·796	..	206	·209	3,440
CS_2 ,, ,, ,,	566		2·640	..	114	·157	1,430
Aqueous vapour in above	35,741	565,909	0·082 lb. per 100 cubic feet of saturated gases	0·806 lb. per 100 cubic feet of saturated gases	23,359	·480	448,493†
Tarry vapours (disregarded)					21,672	1044·4*	22,625,568‡
Totals	2,057,667	2,898,236	..	..	..	..	26,520,336

* Latent heat at 100° Fahr. = assumed mean temperature of condenser. † In cooling 40° Fahr. ‡ In falling from vapour to water.

follows that a theory of coal gas condensation must be based upon the physics of the contained vapours.

But, it may be queried, is the gas saturated with aqueous vapour as it leaves the hydraulic main? This is matter for experiment; and the following results show that it is so saturated at Vauxhall.

TABLE B.—*Results of Experiments upon Aqueous Vapour in Coal Gas.*

Point where Sample was taken.	Temperature of Gas.	Aqueous Vapour found per 100 Cub. Ft.	Theoretical Quantity required per 100 Cub. Ft.	Difference.	Remarks.
	Deg. Fahr.	Lb.	Lb.	Lb.	
Hydraulic main outlet	145	·918	·909	+ ·009	Saturated
Hydraulic main outlet	130	·637	·630	+ ·007	,,
Hydraulic main outlet	140	·813	·806	+ ·007	,,

The writer need say no more regarding the figures in Table A. They have been for some months in print, and, so far, have not been challenged. He can only hope that they may be taken in hand, verified, and completed by a specialist in the chemistry and physics of coal gas—one fully conversant with the daily routine of gas manufacture—and that, so amended, they may be of real use to all interested in the subject.

PULL OR PUSH.

Upon which side of the exhauster should gas be condensed? This question—or rather, perhaps, this inquiry, for the writer is unaware that, from the standpoint of theory, any controversy exists—naturally arises in connection with a paper such as this. Moreover, the point has recently been made the subject of an interesting historical reference. The President of the Midland Association, in his recent address to the members (*ante*, p. 546), when dealing with the subject of naphthalene, made the following statement:—

> I still retain a very lively recollection of its abundance at the Nine Elms works fully thirty-five years ago. . . . I recollect also the great improvement made by my former chief, Mr. Robert Morton, by the simple expedient of causing the gas to be drawn, instead of pushed, through the condensers, and also by adding to the latter by means of pipes carried horizontally round the walls of the retort-houses.

It is necessary to inquire how, or in what degree, such a conclusion is supported by theory.

The term "condensation," applied to foul coal gas connotes two separate and well-defined consequences of a fall in temperature—

1.—The cooling of the permanent gases, resulting in definite and regular shrinkage of volume.
2.—The cooling of the vapours (condensation proper), followed not by contraction of volume, but by physical change of state from the aëriform to the liquid or the solid condition.

General practice points to an opinion that these ends are more easily attained by cooling under exhaust.

Expansion, *per se*, is adverse to condensation, because it offers additional space for diffusion of vapour. This is beneath notice at the inlet of the condenser, where conduction and radiation are greatest, and the mixture is rapidly contracting by cooling; but its effect is cumulative, attaining its maximum precisely at the point—viz., the terminal of the condenser—where the difference between the temperature of the gas and that of the cooling agent has fallen to its minimum, a difference upon which the efficiency of conduction directly depends. On the other hand, expansion is accompanied by disappearance of sensible heat due to the work done by the gas in expanding under reduced pressure.

The following table shows that the Vauxhall gas is still saturated with aqueous vapour at the exhauster inlet:—

TABLE C.

Point where Sample was Taken.	Temperature of Gas.	Aqueous Vapour Found per 100 Cub. Ft.	Theoretical Quantity required per 100 Cub. Ft	Difference.	Remarks.
	Deg. Fahr.	Lb.	Lb.	Lb.	
Exhaust inlet	95	·258	·245	+ ·013	Saturated
,, ,,	94	·243	·238	+ ·005	,,
,, ,,	96	·254	·252	+ ·002	,,

Hence we must conclude that the actual fall in temperature due to expansion is in greater ratio than the theoretical increase of volume; in other words, regarding these as *plus* and *minus* quantities, their algebraic sum makes for condensation.

The works at Vauxhall have increased their output by 80 per cent., upon the same area and within the same four retort-houses, in ten years. As a consequence, both condensing and purifying areas are less than is usual in works which are capable of producing from 13 to 14 million cubic feet in 24 hours.

It follows that exhaust and pressure run high; and adding the one to the other, the gas has, upon occasion, in its passage through the exhausters, to sustain a blow which is the equivalent of 60 to 70 inches head of water. This is accompanied by an increase in temperature amounting to 18° or 20° Fahr. Neglecting friction, the author found difficulty in referring this great difference to compression alone; and he surmised that it was in part traceable to the latent heat of water vapour, squeezed out by pressure, running away as a hot effluent, and, strictly speaking, not being condensed at all. This very attractive hypothesis assumed a great advantage for condensation under pressure, but it was disproved by an experiment upon atmospheric air; and a calculation went to show that, if the inlet gas were saturated, the increase in temperature would enable it, though under much higher pressure, to hold in suspension very much more water than it carried.

The following experimental results show that Vauxhall gas is unsaturated at the outlet of the exhausters:—

TABLE D.

Point where Sample was Taken.	Temperature of Gas.	Aqueous Vapour Found per 100 Cub. Ft.	Theoretical Quantity required per 100 Cub. Ft.	Difference.	Remarks.
	Deg. Fahr.	Lb.	Lb.	Lb.	
Exhaust outlet	110	·258	·373	− ·115	Not saturated
,, ,,	110	·243	·373	− ·130	,, ,,
,, ,,	112	·254	·402	− ·148	,, ,,

It must be admitted that the work of the condenser on the pressure side is increased by the additional heat, be it much or little, mechanically put into the gas by the exhauster, with the result that condensation is correspondingly retarded; and it is evident that the Nine Elms condensers were made more efficient because (1) their work was reduced, and (2) their area was increased. Nevertheless, from

the theoretical standpoint, the disadvantage attaching to condensation under pressure is, after all, of small importance. In fact, it must, in works where exhaust and pressure are within normal limits, be negligible; for at Vauxhall, where both are unusually high, a change to the pressure side would only increase the load by 4 per cent.

Theoretical Position of the Condenser.

This would appear to be the position where it possesses the greatest self-cleansing facilities, together with the maximum advantage derivable from the highest head of difference between the temperature of the gas and that of the cooling agents, the latter being the true factor of efficiency in condensers. Such position is necessarily found in closest proximity to the retorts.

Automatic Cleansing.

The author, upon taking charge at Vauxhall, met for the first time with a reversible condenser; being that described in a paper by Mr. Carpenter, written in 1895.* It is of the ordinary tubular and horizontal type, air-cooled. Reversal may be followed by temporary trouble with the relieving drains, but such obstruction is easily moved. The condenser thus cleanses itself, and, although of a type which is unlikely to be again erected by the South Metropolitan Company, is, from the standpoints of simplicity and regularity of working, a satisfactory piece of apparatus within the limits of the temperatures between which it works; for it must be admitted that it cannot cool to atmospheric temperature the gas it carries.

The figures in Table E are the results of experiments upon this condenser. The author thinks they may be of interest because they indicate the duty which may be expected of such an arrangement in a manner which he believes has not before been attempted. The calculations are based upon Table A.

Table E.—*Rate of Flow of Heat through Cast-Iron Pipes to the Atmosphere.*

Experiments upon an 18-inch Pipe Condenser carried on a Retort-House Wall at Vauxhall.

The Surface of the Half-Condenser between the Thermometers is 3876 sq. ft. and its Length 822 ft. 6 in.

Date.	Gas per Hour in Cubic Feet.	Mean Speed in Condenser in Feet per Second.	Inlet Temperature. Deg. Fahr.	Outlet Temperature. Deg. Fahr.	Atmospheric Temperature. Deg. Fahr.	B.T. Units Removed per Hour.	B.T. Units Removed per Square Foot per Hour.	Units Removed per Square Foot per Hour per Degree Difference of Temperature.
				As Initial Half.				
1901								
Jan. 2 .	123,676	26·40	140·0	120·0	41·0	751,734	193·90	2·18
Dec. 19 .	99,615	23·27	152·3	130·0	44·0	964,200	248·40	2·56
,, 20 .	110,381	23·19	140·6	111·0	39·3	900,317	232·20	2·68
1902								
Jan. 13 .	124,859	27·05	145·6	114·3	42·6	1,226,414	316·37	3·62
,, 14 .	126,628	28·85	150·6	124·3	41·3	1,300,243	335·40	3·48
,, 15 .	126,472	29·57	153·0	128·6	42·6	1,335,125	344·40	3·50
Feb. 12 .	133,796	30·65	150·6	126·3	38·0	1,302,435	336·00	3·34
,, 14 .	138,086	29·45	142·0	114·6	38·3	1,119,509	288·80	3·21
Mar. 17 .	99,233	21·96	146·6	121 0	55·4	886,874	228·80	2·92
,, 18 .	100,080	20·39	143·5	111·4	52·9	938,087	242·03	3·24
							Aver. .	3·07
				As Terminal Half.				
1901								
Feb. 21 .	129,745	25·50	120·6	112·0	38·3	227,035	58·50	0·75
1902								
Mar. 24 .	103,666	19·34	112·5	97·1	43·2	239,409	61·77	1·00
April 7 .	101,640	19·09	114·6	97·4	43·9	272,494	70·30	1·13
							Aver. .	0·96

Experiment upon the Initial 92 ft. 8 in. Run of the Condenser. Surface = 436·4 sq. ft.

1902								
April 9 .	101,106	22·58	141·6	132·5	42·0	341,738	783·08	8·24

The main point of interest is the fact that the efficiency of the condenser per unit of surface per degree difference of temperature does not work out as a "constant," as had been anticipated from published results of experiments upon conduction of heat made outside the gas industry, whether upon water alone, steam alone, or dry air or other gas alone. Such presumably would be the case in gas condensation—*ceteris paribus;* but the other things are not equal. We have to cool a mixture of gases and vapours; and as temperatures come down, there is proportionately less aqueous vapour to fall to water, while the gas itself has far less heat per degree to part with.

* See "Journal," Vol. LXVI., p. 1025.

Maximum Difference of Head of Temperature—True Factor of Efficiency.

The figures, which are working results, indicate that the loss of efficiency per square foot as temperature falls (a fact necessarily true of any condenser) is especially characteristic of the air-cooled tubular type.

Such arrangements, if in proximity to the retorts and reversible, will give fair results while the temperature remains high; but after leaving the retort-house walls, such pipes become little more than conduits to the exhauster, for in summer they cease for many hours daily to be condensers at all, and in winter they become lagged with naphthalene. Hence their mere lineal extension, to give what is termed "time contact," will in no sense meet the demand for more efficient condensation. What is needed is to bring about "accelerated," as contrasted with "retarded," condensation—in short, if the paradox may pass, to cool the gas while hot.

Conclusion.

The writer has dealt at length with aqueous vapour, not only because it is the chief source of the heat to be removed, but also because its physics are in great degree identical with those of naphthalene vapour. Where water vapour can exist uncondensed, there may naphthalene vapour remain in suspension, although in quantity infinitely smaller. Can the nuisance be brought within negligible limits by the ordinary process of condensation? The fact is still in doubt; but the outlook is hopeful.

If the final answer should be in the negative, it seems improbable that success will be ultimately attained by further modification of the condenser itself; for excellent examples of this apparatus exist, and its evolution can scarcely proceed much further. What seems to be required is greater control (1) of the apparatus, that it may realize its maximum attainable efficiency between the limits of the temperatures supplied to it; and (2) of the cooling agents, in order to effect, if possible, an extension of those limits of temperature.

Control of the Apparatus.

Air Side.—A great disadvantage of the ordinary air-cooled condenser is that it cannot be adequately shielded from external sources of heat without hindrance to access of air. In the combined air and water type, the space occupied is so greatly reduced that the condenser can easily be covered. It is then but a step to enclose it entirely, when at once the fan offers itself for the production of a current of air—a tangible advantage, because the activity of surface conduction is quickened by the removal of heated air. A further advantage, varying with the humidity of the atmosphere, is attainable by use of the fan.

Experiments at Kennington have shown that, by increasing its aqueous saturation, air may be sensibly cooled. Time is required to establish reliable statistics on this point; but, so far, the highest difference realized has been 3° Fahr. The double advantage of a current and of a cooled current might possibly pay the cost of running the fan.

Water Side.—In this direction the combined condenser is well under control; but, if not shielded, enclosed, or partially lagged, the air may, and the sun will, be found to be undoing the work of the water. Table F gives a comparison of the average air and water temperatures in the Thames Valley last year. Gas can certainly be cooled within a few degrees of the temperature of the water supply; but by such means it cannot be reduced to that of average air. If, therefore, gas can be water cooled to the lowest temperature of distribution, it must be because the earth covering the mains and services is a bad conductor, responding but slowly to atmospheric changes.

Should natural temperatures be found inadequate, can artificial temperatures be resorted to? Knowledge that the volume of aqueous vapour diminishes rapidly as heat is reduced, and that cooling permanent gas is but a small part of condensation, leads the author to think the idea can be entertained. It would be necessary to cool but a small quantity of the water—say, 10 per cent.—from (say) 68° to 52° Fahr. in summer, and from 46° to 30° Fahr. in winter. There is reason to believe that plant to cool this quantity by

TABLE F.—*Monthly Average Temperatures of Air and Water for the Year* 1901.

(By the courtesy of Dr. Frank Clowes, of the Engineer of the Chelsea Water-Works, and of the Meteorological Office.)

—	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Remarks.
Water	39·77	37·53	42·19	49·83	56·74	62·40	68·00	65·58	59·63	51·96	42·53	39·30	Surbiton
,,	41·62	38·18	40·05	46·87	55·18	61·50	67·60	67·40	62·18	57·37	48·00	41·60	Crossness
,,	41·00	38·00	41·10	47·60	55·70	62·30	68·00	67·60	62·40	55·40	48·70	42·70	Barking
,,	38·60	36·00	40·40	50·00	56·00	62·00	67·60	67·50	61·50	56·00	44·00	41·00	London district
Average	40·25	37·43	41·05	48·57	55·90	62·05	67·80	67·02	61·43	55·18	45·91	41·15	..
Air	36·10	35·10	40·10	52·90	59·10	61·50	66·70	61·20	58·90	49·00	37·50	37·80	Surbiton
,,	39·00	36·00	39·90	49·20	54·80	60·00	66·40	64·00	59·40	50·60	40·60	39·40	Brixton
,,	39·20	34·70	39·50	48·10	50·90	58·90	64·60	62·60	57·80	51·00	42·60	38·90	Greenwich
Average	38·10	35·27	39·83	50·06	54·93	60·13	65·90	62·60	58·70	50·20	40·23	38·70	..
Average difference of air from water	−2·15	−2·16	−1·22	+1·49	−0·97	−1·92	−1·90	−4·42	−2·73	−4·98	−5·68	−2·45	..
Humidity per cent.	89	85	87	72	74	74	79	77	83	91	87	89	Brixton
,, ,,	86	81	78	70	68	65	69	70	77	85	84	89	Kew

the ammonia process, including a gas-engine, could be laid down for a capital expenditure varying as follows:—

For 2½ millions per day	£225 per million.
5 ,, ,,	140 ,,
10 ,, ,,	100 ,,

The author's sincere thanks are due to Messrs. D. Chandler, R. Collins, and C. B. West, for their able assistance in the preparation of the experimental and other data for this paper.

Discussion.

Mr. BROWNE, at the close of his paper, said he must ask permission to make a qualification of a statement in the earlier part. It had been already lodged in the Secretary's hands, when it was brought to his notice that a paper on the proportions of condensers, appearing in the "JOURNAL OF GAS LIGHTING" for 1878, was in existence. He at once read it with very great pleasure and profit; and when he told them the name of the author was W. H. Y. Webber, it was unnecessary to state further that it was far more technical, scientific, and exhaustive of the subject than his paper could for a moment pretend to be. He could only express his sincere regret to Mr. Webber, and to any other author (because there might be others whom he had overlooked), for the injustice he had done to him or to them, and the great pleasure it gave him to have this early and public opportunity of rectifying his mistake.

The PRESIDENT said they would all agree that Mr. Browne had given a useful and suggestive paper; and he hoped there would be a good discussion on the points raised.

Mr. W. H. Y. WEBBER (London) said it was only necessary for him to state that he was not conscious of having received any injury whatever from his friend Mr. Browne; and he could only reciprocate by saying that if he had read this paper in 1878, he should not have written that article. But a good deal of water had run over a great many condensers since 1878; and he was perfectly certain there was nothing in the article to destroy the great merit of the researches and conclusions Mr. Browne had now brought forward.

Mr. CHARLES HUNT (Birmingham) said he should have liked to hear what was in the article of 1878, but presumed, from what had fallen from Mr. Webber, there was nothing in it to interfere with the free discussion of the paper, which was one to set one thinking as to what really was in the mind of the author—whether simply the cooling of gas down to a certain temperature, or cooling it in such a way as at the same time to take out the naphthalene. Moreover, it had been written to some extent from a text furnished by himself. The author had kindly alluded to a reference he made a short time since to an old experience of his (Mr. Hunt's) when he was at the Nine Elms works, for which he was evidently at a loss to account, but appeared to have concluded that the benefit which seemed to have followed from drawing instead of pushing the gas through the condensers was in reality due to the capacity of the condensers having been enlarged. This, however, was hardly a correct explanation, because the incident of the alteration of the condenser connections stood by itself, and took place before the addition of the pipes round the retort-house to which he had referred. It was the fact that, by changing the condensers from the "push" to the "pull" side of the exhauster, the stoppages of thick tar and naphthalene, which had been of frequent occurrence, were greatly reduced. The additional pipes round the retort-house also afforded some further relief. Mr. Browne seemed to think that pipes placed in that position were of little good, because when the sun was shining they were not condensers, and when the sun was not shining, or when the temperature was lower, the naphthalene was deposited in them. At the same time, he told them that rapid cooling was the right thing. He did not quite see how those two statements could be reconciled, because it was evident that rapid cooling resulted in the deposit of naphthalene in these horizontal pipes. This it should be their aim to avoid in any part of the condensers, and instead to cause the naphthalene to be removed automatically by the solvent constituents of the tar. Some experiments he had been making recently rather led him to the conclusion that rapid condensation was undesirable; but he was quite open to conviction on this point. It was one on which he should be very reluctant to speak dogmatically; and he would be glad if Mr. Browne could throw any further light upon it, or relate the experience which had induced him to conclude that rapid cooling was desirable. With regard to the water-cooled condensers, the author seemed to have quoted the temperature of the river water, which was, of course, very variable. However, they were not all situated on the Thames. He might with almost equal reason have cited the average temperatures of the water in the Birmingham Canal; but that would not have greatly advanced the subject under discussion. In his case, he discarded all supplies which were subject to the influence of the atmosphere, and employed only deep-well water, which was fairly constant in temperature throughout the year; but even with this water, which seldom or never rose above a temperature of 54° to 57° Fahr., they were unable to get the gas down to the temperature to which it was subject in the distributing mains in the summer time. This had led him to a similar conclusion to Mr. Browne's—namely, the possibility of using artificially cooled water. He had, however, been very reluctant to recommend it, because it seemed to introduce a complication which was undesirable, if the object could be effected in some other way. Therefore, he was hesitating, and was still watching his water-cooled condensers to ascertain how far they already effected the removal of naphthalene, and the probability of success in the event of the temperature being reduced still further. At present, it seemed to him that the mere reduction of temperature would only lead to the deposit of naphthalene; and while it must be admitted that this had better take place at the works than in the district, it would be still better to avoid it altogether, and cause the naphthalene to be removed automatically by means of the tar, in the practicability of doing which he was a firm believer. He had proof already that the tar obtained from these water-cooled condensers—which, by-the-bye, were placed at the outlet of his air condensers—was sufficient to take out of the gas practically the whole of the naphthalene which still remained in it on leaving the works, from which it appeared to him that their endeavour should be to bring the gas into sufficient contact with the tar, in order to effect the object in view. This induced him to believe that slow rather than rapid condensation was the solution of the question, and that the gas should be held up, as it were, in the earlier stages of the process of condensation; the temperature being brought down (if necessary)

at the finish, to the lowest point which would be reached in the distributing mains. He would therefore feel much obliged if the author would state the reasons which had induced him to arrive at a different conclusion.

Mr. R. O. Paterson (Cheltenham) thought there was a little misunderstanding about this paper from the title of it. "Coal Gas Condensation" did not sufficiently cover the whole field traversed; and if the title had been "The Treatment of Gas from the Retort-House to the Exhausters or to the Purifiers," it would have more clearly covered the ground. He imagined Mr. Browne's idea in saying that he believed in rapid condensation was not so much that he believed in rapid cooling as in the quick removal of the water and tarry vapours from the gas before they had travelled very far from the retort-house. This might be done by many different processes—by heavy pressure, or by contracting the aperture through which the gas was passing, and so jamming or rubbing the vapours together, uniting them, and causing them to fall down out of the gas further on. But that was not cooling simply. It was a means of extracting water and other vapour. Mr. Browne had rather confused them, therefore, by adhering to the term condensation, whereas, as a matter of fact, the larger portion of his valuable researches had relation to the removal of water and tarry vapour from the gas. All who had to do with sulphate of ammonia manufacture, knew that, if they allowed the carbonic acid and the sulphuretted hydrogen gases to travel together through the cooling pipes or condenser at the outlet of the saturator, until the temperature was reduced low enough to turn the gas (say) into an oxide purifier, the devil-water was in the most atrociously foul condition; but if it was drawn off at a high temperature, it would be found to be comparatively sweet. The same thing applied to Mr. Browne's proposed plan for the treatment of coal gas. The condensation of coal gas, as they had generally understood it so far, was not purely and simply a process of cooling. They had in the gas tarry and ammoniacal vapours; and they wished to retain the gas in contact with those vapours as long as possible, so that, on the one hand, the tarry vapours would take up the troublesome naphthalene and convey it to the tar-well without trouble, and, in the case of the ammoniacal vapours, that they would dissolve the sulphuretted hydrogen and carbonic acid gases, and take them away to the liquor-well. Condensation was not simply a matter of getting gas down as rapidly as possible to the temperature desired. It was a question of what they were going to do with the gas which contained those very elements of purifying power which they had to provide in the purifiers proper at a later stage; and it had been their aim to get as much done as possible in the condensers with these very substances that Mr. Browne was proposing to take out in the most rapid manner possible. He agreed with Mr. Hunt that long contact or long travel of the gas with the tarry vapours was the best method of removing naphthalene. He might give a rather striking instance which had occurred to him. He considerably enlarged his retort-house one year; and before he could get the main in the retort-house increased in length, the winter came upon him, and he had to go on with a larger number of retorts with the same mains as he had before. In the previous year, there was no trouble with naphthalene on the works; but that year, with the largely increased volume of gas passing through the same mains, he found he was troubled with naphthalene at a certain point between two sets of purifiers. He had the greatest difficulty in getting through the winter. Next year he increased the length of the pipes in the retort-house, making the foul mains better proportioned to the quantity of gas; and he never had the slightest trouble from naphthalene at that point again. He attributed the freedom entirely to the extension of the mains in the retort-house.

Mr. Charles Carpenter (London) said, however much the members might differ with regard to some points raised in the paper, there was no doubt they were all under a great debt to Mr. Browne for the careful investigation he had made into the work done by the condensing gas. Before he took the matter in hand, as he had done, there was, as far as he was aware, no information as to the energy which had to be absorbed in the condensation of gas. With reference to purification, they knew they had certain impurities to take out in certain quantities; and it was an easy matter, comparatively, to proportion the plant to the impurities to be dealt with. But with regard to the condensing of gas, they were quite in the dark as to what was the proper form of, and in what quantity one should apply, the cooling medium. Mr. Browne's investigation had set this matter at rest; and he was entitled to very high praise for the careful manner in which he had pursued his investigations. With regard to the naphthalene question, they wanted at starting to make up their minds to one of two things—either to look at naphthalene as an impurity which was best taken out of the gas as rapidly as possible before it gave trouble, or to look upon it as a valuable illuminating hydrocarbon, and endeavour to carry it right up to the point of combustion. The conclusion he had come to was that naphthalene was a troublesome impurity; and the sooner they got it out of the gas the better. It was necessary to clear this up, because it was apparent from the discussion that there was still a certain amount of doubt existing in some people's minds on the point. One speaker that morning had given his experience with regard to the stopping up of the annular pipe or passage round a gasholder tank; but his (Mr. Carpenter's) contention was that, by the time the gas reached the passage surrounding the holder, it should have been wholly free from naphthalene, and none should have been left behind to cause a stoppage. Assuming a condition of affairs in which the gas contained sufficient naphthalene to be thrown down under certain cooling circumstances, he said it was only a question of time and place for that naphthalene to come down and cause more or less trouble. As to the slow and sudden cooling, Mr. Browne had stated that there were reasons for endeavouring to cool the gas while it was as hot as possible. This was diametrically opposed to the opinion of many gas engineers who had consistently and regularly advocated slow condensation. Now, condensing with the type of water-tube condensers to which Mr. Browne referred was very rapid. The gas entered the condensers straight away from the exhausters at a temperature 150°, or sometimes more, and was cooled right off in twelve or fourteen vertical lengths of pipe containing water-tubes, to a temperature of between 40° and 50°. Fortunately, they were able to compare the state of affairs as regarded the illuminating power of the finished gas, both under these circumstances and under circumstances where the cooling was of the ordinary slow-speed horizontal pipe pattern. He meant that they had a works which had been working under a slow-speed cooling method, and in which the gas was tested by the London County Council at the testing-station in the usual way. They had now for some time past been working with the rapid method of water-tube condensers; and there was not the slightest difference shown by the tests of illuminating power as determined at the testing-station. A fact of this kind was worth a good deal of theory. All through, the conditions were the same—the coals the same, the heat the same, everything the same, excepting that they made this radical change in the method of condensing the gas. The result was that the finished gas as it reached the testing-station or the consumer did not in the slightest degree differ as regards illuminating power. Another point was with reference to the amount of naphthalene present in the finished gas. They made daily tests for naphthalene, and were extending such tests to all the works. Taking the Bankside works, where the final gas temperature was somewhere between 45° and 50°, the amount of naphthalene found in finished gas per 100 feet was from 2½ to 3½ grains. Mr. Browne had made the important observation that the cooling water as usually obtained was not sufficiently low in temperature to reduce the gas to such a degree as would enable all the naphthalene to be deposited. This was perfectly true; and he thought some system of cooling water down below such temperature was desirable from two points of view. In the majority of cases, the trouble from naphthalene had been a long-continued one; and he did not think he was beyond the mark in suggesting that, in the mains of South London, there were many hundred tons of naphthalene. Now if a method could be applied of artificially lowering the temperature of the cooling water of a condenser, and therefore the outlet gas, to such a point that, instead of having even 2 or 3 grains of naphthalene, it was completely free from it, then this gas would go out into the district, and in the course of time would lap up and absorb and carry forward, in a small degree, but continuously, the naphthalene at present remaining in the district mains. He was not at all sure whether it was necessary to carry out the artificial cooling in the manner proposed by Mr. Browne, because the use of ammonia compressors—which was what he understood to be intended—was rather costly. He went into the question last autumn, with one of the large engineering firms who

made such apparatus a speciality; and he was rather surprised at the magnitude of the plant suggested for the purpose. He thought a better way would be if the cooling water were passed through a series of small tubes, which could be covered with canvas, over which water should trickle, and round which large volumes of air could, by means of a fan, be kept in motion. The evaporation produced by the current of air would, he thought, readily and economically lower the temperature of the water to the point required. With regard to the use of the condensers made reversible in the manner now familiar, the main point about them was the facility they afforded for self-cleaning. Instead of having to steam out the condensers at short intervals, when they were clogged up with naphthalene, they found the one they had put up at Bankside was as clear to-day as when it first started; and, as far as he could see, there was no reason why the alternate process of blocking up and cleaning should not automatically go on as long as it was necessary to pass any gas through them.

Mr. HUNT asked down to what temperature the gas was condensed which contained 2½ grains of naphthalene.

Mr. CARPENTER replied that the mean temperature was about 48°.

Mr. E. A. HARMAN (Huddersfield) said the subject of the paper looked very attractive; but after hearing it, he found that it was only an old friend again—namely, the naphthalene nuisance, because it all came down to that. It was somewhat refreshing to find there was such a thing as napthalene in existence in other towns than the one in which he resided. Sometimes one was asked to believe that naphthalene had been abolished; and, under the circumstances, he was glad therefore to be in such excellent company as that of Mr. Hunt—for he admitted that even in Birmingham they had naphthalene. They had had blockages on the district in Huddersfield from time to time during the season, and probably they would again. This led him, a year or two since, to consider and inquire pretty extensively respecting various refrigerating processes. Mr. Browne, at the end of his paper, gave the price he thought sufficient per million cubic feet for capital expenditure for the ammonia refrigeration process; but he believed the figures were considerably under the mark. Prices he had obtained were certainly double those given. The only thing which had kept him back from adopting some refrigeration process had been the important item Mr. Hunt had so ably referred to—the rapid cooling of the gas. His own conviction—he was going to say his lifelong conviction—was that gas must be cooled gradually; and it was very difficult, in spite of the result of all the experiments named, to abolish the personal equation, and get rid of the idea that rapid cooling was wrong. He was himself perfectly convinced that gas should be cooled gradually; and he should like to ask the author whether he knew of any works in which the refrigeration or ammonia process was in use for the cooling of gas. One other item in the paper struck him as being rather exceptional, and that was the great increase in the temperature of the gas from the inlet to the outlet of the exhauster, which was put at 20°. This was higher than he had ever heard of before, or obtained.

Mr. W. E. PRICE (Hampton Wick) said that he was very pleased at having the opportunity of hearing this paper, which did great credit to the author and those who had worked with him; and the tables would no doubt repay careful examination over and over again. He gathered that Mr. Browne had not finished his experiments; and he hoped he would proceed further, and that at a future time he would be able to give the members rather more definite opinions upon some points than he had that day. Probably he might be able then to alter the opinions he now expressed. The point Mr. Hunt had raised was one of the most important in the paper—in fact, he had marked it himself. It seemed to him to be one which was hardly in accord with the experience of others—that it was better to condense gas suddenly. He used the term "time contact," which had been used before, and said it rather indicated that the condensation should be a slow matter. He said also that if one condensed quickly after leaving the retort-house, the pipes when the temperature was high became little more than conduits to the exhauster, for in summer they ceased for many hours daily to be condensers at all, and in winter they became lagged with naphthalene. The question of condensation was primarily to get rid of naphthalene. Within reasonable limits, they did not care much what the temperature of the gas was, provided the naphthalene was out of it. Of course, there were limits which affected the other purifying arrangements; but as to the naphthalene, it could best be got out by slow condensation. If the gas were slowly cooled, it had time to come in further contact with the light tars; whereas if it were done suddenly, the pipe itself got lagged with naphthalene, which, if done slowly, would be passed away by absorption in the lighter tars and oils. The work he had done indicated that slow condensation was the proper method, rather than the rapid. In his reply, he should like Mr. Browne to throw a little light on the paragraph which followed, which said that what was needed was to cool the gas while hot. He did not quite see what this meant. He was sure the paper would help forward the question with which the Southern Association were actively concerned.

Mr. J. S. REEVES (Bilston) remarked that, without wishing to detract from the excellence of the paper, he should like to say he was very much surprised at the conclusions at which the author had arrived with regard to rapid condensation. This was quite contrary to his own experience; and he might mention one experience he had a good many years ago. The engineer of the works with which he was connected, in building a gasholder, had to erect his tank above ground. He provided a hollow belt, which ran round the circumference of the tank; and the tank was supplied, by a pumping-engine some distance away, with water pumped from the mines. The whole of the water required for the works was taken from the gasholder tank. The box round the circumference of the holder was used as a condenser. Immediately it was put to work, they found there were complaints of the deposit of naphthalene. It was discontinued, and again and again tried, with precisely the same result in each instance. When he took charge of the works several years after the erection of this gasholder tank, he tried the thing again himself, with exactly the same result. The point aimed at by the engineer was a rapid condensation of the gas; but he had come to the conclusion that this was entirely a mistake. What was required was slow condensation. In providing new condensers, he had horizontal pipes put into a house, and shielded both from severe cold and also from the sun's rays; and he had never had any complaint since of deposit of naphthalene. He believed its formation was very largely due to the method of condensing the gas, and was very much surprised at the statement put forward by Mr. Browne; it being not only contrary to his own experience, but to that of a great many engineers with whom he had conversed. It was an interesting paper, and would perhaps lead them to reconsider the matter, and discover some point in it which might be useful. In reply to the President, Mr. Reeves said he found the deposit of naphthalene both in the district and on the works. It deposited itself first in the condenser and in the mains leading from the works, and later in the consumers' services.

Mr. C. F. BOTLEY (Hastings) said he was not able, without further consideration, to criticize these figures very much; but there were one or two points arising out of the discussion which he should like to refer to. With regard to the automatic cleansing of a reversible condenser, there was one important point which was lost sight of. It depended to a great extent on the coals which were being used. Some coals produced proportionately a larger amount than others of solvents which would dissolve naphthalene. Again, with regard to the water vapour, he was very glad to see the author had put it down definitely that the physics of water vapour and naphthalene vapour were practically identical, remaining in suspension together. This was an important point which had often been controverted. He might also mention that, with regard to cooling gas-condensers, a very ready means was by producing an automatic mist of water, the effect of which was surprising. Using atomized water with air condensers, it was possible to get a very high efficiency. When well water was not available, such a method as Mr. Carpenter proposed, of cooling the water down to a greater extent, would obviate anything in the way of the ammonia process, which he inquired into some years ago, with the idea of refrigerating the gas; but he was alarmed at the capital expenditure involved, and it had to be dropped really on that ground.

Mr. WILLIAM FOULIS (Glasgow) remarked that he could not say much on the question of naphthalene, because it was not a thing which troubled him to any extent; but there was evidently a great difference of opinion as to the best method of condensing gas. His experience led him to the conclusion that slow condensation was much more beneficial than rapid condensation. The condensers at his

works were so arranged that they were able to maintain the gas at the outlet of the condensers at a temperature of about 65° or 70°. They endeavoured to prevent the gas falling below this. If it did fall to a lower temperature, it was almost sure to suffer in illuminating power. Of course, the conditions might be entirely different when a large quantity of naphthalene had to be dealt with. In the new works now being built at Glasgow, it was proposed to put up atmospheric condensers for slow condensation, principally for the purpose of removing the heavy tars; the gas being afterwards reduced to the desired temperature in water-tube condensers so arranged as to give full control and regulation of the temperature. Experience seemed to differ so much on this point that he thought it must depend on the original composition of the gas with which they had to deal.

Mr. Thomas Glover (Norwich) remarked that at the beginning of the paper the author said it was evident that a theory of condensation must be based upon consideration of analysis, specific gravities, specific heats, and physical conditions; but later on he said a theory of coal-gas condensation must be based upon the physics of the contained vapours. He did not know whether the two statements were quite consistent; but they seemed a little bit confusing. Then the question of putting condensers after the exhausters was a matter which many of them would like to hear more about, and was perhaps worthy of consideration. Mr. Hunt had stated that very great relief was found from naphthalene stoppages when the condensers were put after the exhausters; and one would like to know if he had carried this out in practice at Birmingham, and if he had got rid of naphthalene in that manner. Then there was a question of the loss of temperature due to the extraction of water vapour. Mr. Browne said there was an increase of temperature, which he could not quite understand. He said: "It follows that exhaust and pressure run high; and adding the one to the other, the gas has, upon occasion, in its passage through the exhausters, to sustain a blow which is the equivalent of 60 to 70 inches head of water. This is accompanied by an increase in temperature." One would have thought that, by taking out this latent heat by the water which was running away, amounting to 18° to 20° Fahr., there would have been a decrease.

Mr. Browne said that was a hypothesis which was disproved.

Mr. Glover asked if Mr. Browne expected to have a reduction of temperature in the gas by taking this water by pressure.

Mr. Browne said no; he should have expected an increase of temperature if that had been the case.

Mr. Glover remarked that if they took off the water, and it absorbed the heat, they would expect a decrease of temperature.

Mr. Browne dissented. He said it would be giving off heat in falling to water.

Mr. Glover said it did not seem very clear. There was one matter about the discussion that morning which indicated that progress was being made on the question of the removal of naphthalene. Though the matter seemed somewhat hazy on details, it was yet clear on the main point, as indicated by the remarks of several speakers, that naphthalene must be dissolved out. Whether it was to be dissolved out by the introduction of oils extracted from tar, or whether the solvents were to be provided by artificial temperatures and pressures, had not yet been resolved upon; but they seemed to be getting to this—that liquids must be introduced or the gas must be brought into contact with liquid solvents, and some engineers proposed to get these liquids by artificial temperatures. The question of accelerated condensation, he thought, might be cleared up a little more. Time-contact was referred to, and insisted upon, by some speakers; but time-contact was nothing unless one had a reduction of temperature. Time-contact would be very valuable for the reduction of naphthalene, if the time-contact was at a low temperature, but not at a high temperature. Early in the discussion of the naphthalene question, the idea of dissolving vapours by vapours was knocked on the head; and it was now known that only liquids could dissolve vapours. Therefore, if one condensed out the light oils, the solvents of naphthalene, and kept them in contact with the gas charged with naphthalene, there was an opportunity for the liquids to dissolve out the naphthalene. It was thus not a matter so much of accelerating or retarding the condensation, as of bringing the naphthalene charged gas into contact with these condensed oils, and keeping it there until the oil had a chance of dissolving out the naphthalene. It was not only a question of the reduction of temperature and time-contact, but of surface-contact as well.

Mr. Browne, in reply, said he had to thank Mr. Hunt for the very kind way in which he had taken the reference to the interesting statement he had lately made of what occurred at Nine Elms so many years ago. Mr. Hunt asked him what was in his mind in writing the paper. Was it the mere cooling of gas or the removal of naphthalene? After what Mr. Carpenter had so kindly said upon the subject, which had rendered many remarks on his part unnecessary, he need not hesitate to say that what they were aiming at was to remove naphthalene in their condensers. Before the naphthalene could be got rid of, the temperature must be reduced. It could only be taken out in the condensers by cooling. Mr. Carpenter had given an interesting statement, to the effect that he was doing this without any reduction in the illuminating power of the gas. Mr. Hunt had added further interesting points to his recent statement with regard to the change from the pressure to the exhaust side made at Nine Elms. He said the change preceded the addition of new condensers, but that nevertheless an immediate benefit was felt, and that stoppages did not exist; but whether he meant on the works or in the district he was not quite certain.

Mr. Hunt remarked that he meant in the condensers.

Mr. Browne said he was very interested to know the reasons Mr. Hunt could adduce for the advantage claimed; and he would suggest to him that the stoppages to which he alluded were probably removed because he was nearer to the retort-house on the exhaust side than on the pressure side, and that hotter gas reached the condensers, and therefore naphthalene was more likely to be dissolved out. He did not quite understand whether, when Mr. Hunt used the word "reversal," he meant that he employed a reversible condenser, or merely referred to the change from one side of the exhauster to the other. Mr. Hunt asked why rapid cooling was desirable. He thought it would be admitted, in view of the statement by Mr. Carpenter, that if gas could be rapidly cooled in a comparatively small apparatus occupying a small area without any final loss of illuminating power, it must be desirable to cool it quickly in a small apparatus rather than slowly in those miles of pipes which were seen in large works. Mr. Hunt also made some interesting remarks with regard to the refrigeration of water; and he was glad to hear him support this proposal, which was subsequently referred to by Mr. Botley and Mr. Carpenter. It had been suggested by one speaker that he had put the probable cost of such apparatus much too low; and this was confirmed by Mr. Carpenter's remarks. But he could only say that he had put the matter before a very prominent individual in the industry, who, he found, had not a correct idea of the amount of work that he was asking him to undertake. He put it much higher than he (Mr. Browne) was ultimately able to convince him was necessary, when, seeing that the final quantity of heat to be removed from the gas was trifling, he had assured him that he would be very glad indeed to undertake a large business on the basis of the figures here given. On the question of rapid cooling, to which nearly every speaker had alluded, he had this further to say—that he had been making some experiments in this direction with a small piece of apparatus, in which he had subjected the gas to far more drastic treatment than would be possible in ordinary working; and the conclusion to which he came was that, on a working scale, it was a physical impossibility to cool gas suddenly. By immensely increasing the area, or (which was the same thing) by reducing the quantity some 2000 or 3000 per cent., he did at last succeed in bringing the gas down quickly from a temperature of 140° to the temperature of water; but it could not be done on the working scale. In water condensers it was usual to put the water in where the gas was coldest, and it was heated before it reached the hot gas; the gas and water flowing in opposite directions. With regard to time-contact, the idea seemed to be that, as the gas was cooled, it was brought more freely into contact with the lighter tars. Now it appeared to him that the lower the temperature, the less the quantity of the lighter tars which would be available for the purpose of dissolving out the naphthalene. Those oils fell out rapidly as the temperature was reduced; hence the latter portions of tubular air condensers became lagged with naphthalene, simply because there was not enough solvent to keep them clean. This was why he kept insisting upon the necessity

of cooling the gas while hot in a comparatively small apparatus, which should be placed in the position with regard to the retort-house in which it would have the greatest energy of position and be sufficiently powerful to cool gas from 140° or 150° to the temperature of the water supply. Being reversible, the hot gas would be able to clean the apparatus; and so the process became automatic. Mr. Paterson had spoken of the possibility of extracting water by friction; but he could not follow him. The water carried by the gas existed in the form of vapour—that was to say, in the gaseous form—and he did not see how this was to be removed by friction. One could only remove water from gas by cooling it out. He knew of no other method by which it could be done. He was well aware there was a scrubbing action attributed to condensers; and this was a point which had its due place in Mr. Webber's article to which he had referred. There was also the chemical action of the condensers; but he did not see why this scrubbing action should not go on in the same way, in such a condenser as the Bankside one, for instance. They knew that the scrubbing action was necessary, because some of the water and oils existed in a state of mechanical suspension. This was the reason why some of the experiments at Vauxhall upon saturation were found in excess of the theoretical quantity; the water was there mechanically carried, and so was naphthalene. He had to thank Mr. Carpenter for the great support he had given him. He naturally felt some hesitation in offering this paper, Mr. Carpenter having so recently read one upon condensation, and being highly interested in the subject. But with his usual generosity, Mr. Carpenter had said there was no reason why this paper should not be contributed; and as he felt he had some data which were of value, and which it was desirable to make known, he prepared it. Mr. Botley had stated that automatic cleansing was a question of coals. Of course, they knew that they got a less amount of tar and tarry oils from some coals than from others; but, nevertheless, to his mind, reversibility was really the most useful feature of condensers at the present day. He had no hesitation in saying—though he had not the slightest idea who discovered this very simple improvement—that, whoever he was, he did the biggest thing in condensation, if one of the simplest, that had perhaps ever been done. With regard to water mist, this was a point which he might be allowed to add to those to which he had alluded in the paper. With regard to the experiments made at Kennington, he was not ashamed of them, for this reason, if for no other—that, in making experiments, the next best thing to finding out what one could do, was to find out what one could not do. He had not been able, with the available temperatures, to get more than 3° reduction in temperature by mere absorption of water in the form of vapour. Things might be very different in July and August. A saturation of 70, 60, or 50 per cent., when the weather was cold, meant a capacity for very much less water than the same percentages of saturation at much higher temperatures. He should pursue these experiments. Like Mr. Botley, he had employed an atomizer, and by doing so he had got a fall in temperature twice or three times greater; but how much was due to the machine and how much to the better saturation affected by the mist, to which Mr. Botley alluded, he was not prepared to say. Considering the water was atomized at an air pressure of about 20 lbs., he imagined this had a considerable effect. The expansion of compressed air, as they knew, reduced its temperature rapidly. The result was a very fine mist at a considerably lower temperature. This was of very great value. It was a fact that heat was much more rapidly conducted through iron plates to evaporate water than to merely raise its temperature. Mr. Foulis had found slow condensation much better than rapid; and he was one of those fortunate individuals who was not troubled with naphthalene. As Mr. Price had said, if it were not for naphthalene, some of them would not bother themselves much about condensation at all. Mr. Glover had spoken of the latent heat of aqueous vapour. It was, as he had interrupted Mr. Glover to reiterate, only an hypothesis which had entered his mind that this great increase in the temperature of the gas as it passed through the exhauster might be due to the latent heat of aqueous vapour falling to water, not by condensation resulting from cooling, but by condensation due to compression—*i.e.*, by mechanical condensation. As stated in the paper, this hypothesis had been disproved by a simple experiment. If it were possible to pass the gas through the exhauster without raising its temperature, condensation by cooling might very possibly be more economically effected on the pressure side, because the gas could hold neither so much aqueous vapour nor naphthalene vapour under the heavier pressure; but the fact that this rise of temperature took place, would make an addition at Vauxhall of 4 per cent. to the load of the condenser. But what was 4 per cent.? What was a million units among so many? He had, therefore, come to the conclusion that it was a pure question of convenience. If it was more convenient to have condensers on the outlet of the exhauster than on the inlet, it would make very little difference, so long as one had a powerful condenser, and the gas entering was sufficiently hot to achieve the automatic cleansing referred to. Mr. Glover said the proper way to remove naphthalene was by solvents; but, unless he misunderstood him, he was referring to solvents in special vessels. They were all interested in the removal of naphthalene by solvents in the condensers; but their removal by solvents in special vessels was a different question. To his mind, it was a very beautiful process, of which he believed Mr. Glover was joint author; but it required an extensive plant, and the purchase of these solvents. Also it was conceivable that their disposal after extraction of the naphthalene might be a serious difficulty. It appeared to him, finally, that if the work could be done as Mr. Carpenter had told them he was doing it, by the mere process of condensation without any reduction in illuminating power, this was the most natural, and probably the cheapest, way to achieve the object.

THE SOLUBILITY OF NAPHTHALENE.

By J. F. Smith, of Halifax.

Though several methods for the removal of naphthalene from coal gas as produced at the works have been from time to time introduced, many engineers still prefer, for various reasons, to remove the deposits in the services and mains, when they cause any inconvenience, by means of the force-pump, or by the use of solvents, such as benzol, naphtha, &c. As a rule, the clearing of the services gives but temporary relief, while the introduction of solvents to the street mains seldom produces the desired results, as naphthalene will still show itself in the service-pipes, where, as a rule, the greatest trouble is experienced.

Carburetted water gas gave promise of proving a good preventive of these deposits, as it was thought that this gas contained no naphthalene, and that it would in time dissolve or carry forward the naphthalene from the mains and services to the burner; thus avoiding the necessity for the use of solvents, &c. Unfortunately, however, it has failed to fulfil what was expected of it; and the removal of deposits has still to be dealt with as they occur.

For some time the writer has had good opportunities for observing the formation of naphthalene in the manufacture of carburetted water gas, and he has been able to confirm the statements occasionally made, to the effect that it is possible to make as much naphthalene with a carburetted water-gas plant, both where petroleum and the unsaturated oils are used for enrichment, as in the manufacture of ordinary coal gas.

Though many solvents have from time to time been proposed, information as to the most suitable material to employ is decidedly scarce; and it was with the object of determining this point that the following experiments were undertaken. It appeared necessary at first to compare the solubility of naphthalene in the various solvents at the same temperature, and 60° Fahr. was taken as the standard. A weighed quantity of the solvent under examination was taken, and, when brought to about the required temperature, naphthalene was added until the saturation point was reached. During the time the naphthalene was being added, and while solution was taking place, the temperature was observed to drop several degrees, and it was found necessary therefore, to add a little warm water to the bath from time to time, in order to keep the temperature up to at least 60° Fahr.

After solution appeared to be complete, a little more naphthalene was added, and the temperature was kept constant from half an hour to an hour. At the end of this time the mixture was well stirred, and the naphthalene allowed to settle. A small portion of the solution was then taken, weighed, and the amount of naphthalene in it estimated, by means of Küster's method, with standard picric acid solution. The total amount found was subtracted from the weight of the solution taken, and the quantity present in

100 parts of the solvent was calculated from the figures so obtained. The following are the results:—

	Parts Soluble in 100 Parts of Solvent by Weight.
1.—Benzol	45·80
2.—Toluol	32·00
3.—Xylol	31·50
4.—Cumenes	30·10
5.—90 per cent. commercial benzol	43·20
6.—Solvent naphtha	31·72
7.—Mixture of 50 p. ct. benzol and 50 p. ct. toluol	39·80
8.—Mixture of 30 p. ct. benzol and 70 p. ct. toluol	37·20
9.—50 per cent. commercial benzol	31·80
10.—Carburine, sp. gr. ·672	16·90
11.—Creosote, sp. gr. 1·030, containing 8 per cent. of tar acids	9·65
12.—Scotch blast-furnace oil, sp. gr. ·985, containing 31 per cent. by volume of phenic acids	17·64
13.—Heavy tar oils	8·90

The results from Nos. 1 to 10 inclusive were also confirmed by the addition of weighed quantities of naphthalene to weighed quantities of the solvents, and the results agreed very closely with those given above. The results from Nos. 11, 12, and 13 were obtained after the naphthalene had been removed from the oils by steam distillation, the amount of which was calculated by submitting it to Küster's test.

From these results, it would appear that pure benzol would be the best solvent to use. This would be true supposing that the solution could be removed from the mains as soon as the naphthalene was completely dissolved; but as this is not always convenient, other facts must be taken into consideration. When a solution passes into the mains, through which it has to travel before it can get into the drip-boxes, evaporation takes place. If the distance is great, the solvent is picked up by the gas, and carried forward to the burners, conveying (in the belief of many) some of the naphthalene with it; but the extent to which this is done is, however, in the opinion of the writer, much overestimated.

In order to test this point, experiments were made to find out to what extent the naphthalene would be carried forward with some of the solvents under examination. For this purpose solutions of naphthalene were prepared of a known strength, and placed in a flask provided with inlet and outlet tubes—the inlet dipping well into the liquid. After careful weighing, the outlet-tube was connected to the absorption bottles of the modified Küster's test for naphthalene, devised by Dr. Colman and the writer.* Air was then passed through the apparatus, and when sufficient naphthalene had been precipitated by the picric acid to permit of its being estimated, the experiment was stopped and the precipitate treated as described in the test for naphthalene in coal gas. The flask was then re-weighed, and the difference between the last and the first weighing gave the loss of the solvent and naphthalene carried along with it. From these figures the results were calculated, and the amount of solvent evaporated for each part of naphthalene at 60° Fahr. was obtained. The following are the results:—

Solution of Naphthalene in	Strength of Solution.		Parts of Solvent Evaporated for 1 Part of Naphthalene.
	Commencement.	End.	
	Per Cent.	Per Cent.	
Benzol	6·37	10·78	1168
30 per cent. benzol and 70 per cent. toluol	5·65	8·15	1681
Solvent naphtha	6·42	7·62	645
90 per cent. benzol	6 00	9·00	1588

These figures show that, when the solutions are dilute, the amount of solvent evaporated is large compared with the amount of naphthalene; but as the vapour tension of the solvent is lowered by each addition of naphthalene, it will readily be seen that, when dealing with saturated solutions, the quantity of naphthalene carried along with the solvent will be greater than with the dilute solutions.

A test with a solution of naphthalene in pure benzol at saturation-point gave a proportion of 160 parts of solvent evaporated for 1 part of naphthalene carried with it. From this it will be evident that if a service is cleared with a solvent of very high vapour tension, very little naphthalene will be carried with it to the burners, and that more will be carried with one of lower vapour tension; while in the case of the more volatile solvent a larger amount of naphthalene will be left in the mains if evaporation is allowed to take place therein.

For comparison, saturated solutions of naphthalene in 90 per cent. commercial benzol and solvent naphtha were allowed to evaporate until the residue was dry. The following are the amounts of residual naphthalene left, expressed in percentage of the naphthalene dissolved in the solvent:—

	Per Cent.
Residue left by 90 per cent. benzol	97·6
,, ,, solvent naphtha	89·5

Although these figures show that more naphthalene is carried with a solvent having a low vapour tension, it must be remembered that, if it is wished to remove the naphthalene from the action of the gas, after it has once been dissolved, the 90 per cent. benzol will evaporate about seven times more rapidly than solvent naphtha, and will therefore be less likely to reach the drip-boxes with the naphthalene it may contain.

The figures given for the solubility of naphthalene in creosote, heavy tar oils, and blast-furnace oils, show that the blast-furnace oils are far superior for the purpose of removing this substance from the gas at the works; the amount it will take up varying with the amount of acids it contains. These oils also have another advantage over the coal-tar products, inasmuch as they do not contain naphthalene, while coal-tar oils are difficult to obtain quite free from this.

Discussion.

Mr. A. E. Broadberry (Tottenham) remarked that he should like to say a few words, especially as, at the commencement of his paper, Mr. Smith made a statement that carburetted water gas had failed to fulfil what was expected of it with regard to the prevention of the trouble from naphthalene. He should not like this statement to go unchallenged. At Tottenham, before they commenced the manufacture of carburetted water gas, they were troubled as much as anyone could be with naphthalene deposits; but from the time they began using water gas, they were practically free, except that during last summer, through alterations which were going on in the works, they found it necessary to close down the water-gas plant and use coal gas only. No sooner had they commenced the distribution of coal gas by itself, than they were again troubled with naphthalene deposits in the district. When they recommenced the water gas, they did not find the trouble disappear quite so quickly as it did on the first occasion; and he attributed this in large measure to the fact that when they first commenced the manufacture they were using refined kerosene for enrichment, but last year, when they recommenced after the interval, they used American gas oil. It appeared to him that the refined kerosene had a greater effect upon the naphthalene deposits than the American gas oil. In the first case, practically all the trouble from naphthalene disappeared in the first week; but last year it took six weeks to get rid of it. He admitted that they certainly did work a higher percentage than was usual in most works, because they ran regularly to the extent of 50 per cent. of each gas; and possibly the fact that they used water gas in such a large proportion might have something to do with their freedom from naphthalene troubles. They did make naphthalene in the coal gas, undoubtedly; but the trouble never got out on to the district, and practically they experienced no trouble whatever on the works. The carburetted water gas was made and purified quite separately from the coal gas, and was mixed with it at the inlet of the holders. He had recently noticed, after a holder had been blowing, that there was a slight oily deposit floating on the top of the water which had been blown out from the inside of the holder. Some of this was collected and left in an open basin, when it rapidly evaporated, and left a deposit of naphthalene at the bottom. It appeared to him that some of the oil which separated from the carburetted water gas was acted on by the naphthalene or acted upon it, which caused it to be deposited, and brought down the naphthalene with it probably in the gasholders; and this might account for their freedom from complaint. As to the most suitable oil for use if they intended to extract naphthalene on the works, he might say he thought every maker of carburetted water gas—though he did not say he ought not to make any condensed oil—either would admit that it was practically impossible to make gas without getting some deposit of condensed oil, or, if he avoided this altogether, he would go to the opposite extreme and make water gas in a very bad way. He thought it was that bad method to which Mr. Smith alluded, when he said it was possible to make naphthalene from carburetted water gas to the same extent as in coal gas. No doubt it could be made; but it was very bad

* See "Journal," Vol. LXXV., pp. 330, 798.

practice if it were. If they wanted to extract naphthalene from coal gas, when they made the gas by both methods they had at hand a ready means for doing so. He had tried an experiment on this point. Unfortunately he had no specific data to give, or he should have given it; and therefore he was afraid to speak on Mr. Brown's paper on condensation. But he tried the experiment of passing coal gas through some of this condensed oil, and tested by the photometer what effect it had on the illuminating power. He found it robbed the coal gas of about ¼ candle; and, at the same time, the condensed oil through which it was passed gradually got thicker and thicker, and at last was so thick that the gas would not pass through. It was evident, therefore, that the oil was absorbing naphthalene, and possibly some of the other hydrocarbons in the gas; but this was because they were using too much of it. He believed it would be quite possible so to treat coal gas with condensed oil from carburetted water gas, that the necessary quantity of naphthalene could be extracted from the coal gas to relieve the whole district of any trouble. One thing he was inclined to say with regard to Mr. Brown's paper on condensation, was that for some time past they had been reversing the condenser on the coal-gas plant; and though he was unable to say what effect it had with regard to absorption of naphthalene, it had relieved them of any trouble in cleaning the condenser ever since they commenced it, which was five years ago. They had not since had any need to clean it; while previously they had to clean it out thoroughly every summer. A good deal might be done, in the research which was proposed to be made in regard to naphthalene, in studying this question of the effect of the use of carburetted water gas upon it. He must conclude by again expressing his disagreement with the statement that the use of carburetted water gas had entirely failed in what was expected of it in this matter.

Mr. R. Beynon (Torquay) said he had been empowered by his Directors to examine this question and experiment in a small degree, to see if he could not find some way out of the naphthalene difficulty, from which they had experienced considerable annoyance. He was glad to have this paper by Mr. Smith giving the different values of the solvents; but there was one point which had not been touched upon, and that was the price of these different solvents. Benzol, of course, dissolved a large quantity of naphthalene; but, on the other hand, creosote, though not so good a solvent, was very much cheaper. This question of price had a good deal to do with the solvents to be employed. He quite agreed that it would be much better to employ a solvent or other means to take the naphthalene out at a very early stage of the manufacture. It was no use letting it go on until it reached the governors, and then taking it out there by means of further processes. He had experienced great trouble at certain times of the year, especially in the early autumn, in the inlets of the gasholders, and also the purifiers; and this was one reason why he wanted to take the naphthalene out at an early stage. He proposed making the experiment by utilizing the last one or two chambers of an "Eclipse" washer-scrubber.

Mr. J. L. Chapman (Harrow) said he should like to ask Mr. Smith whether he had noticed carefully the temperatures at which he was working the oil-gas apparatus when the naphthalene was formed. He did not agree with Mr. Broadberry at all, that naphthalene was a sign of bad working. He thought it was a sign of bad working to make condensed oil. There should be a happy medium, where there was no condensed oil and no naphthalene; but the great point was to find out what condition the heat should be in to get this result. He never had any naphthalene until he had a carburetted water-gas plant; and now that he had one, he had the naphthalene throughout the district. He had made several experiments on the matter, and had come to the conclusion that naphthalene was caused from the oil being worked at too high heats. He noticed that, when working high heats and a sack was laid over the tar-seal at the outlet of the condensers, naphthalene formed on it; but as soon as the heats were reduced, the naphthalene passed away. He did not want to make condensed oil either; the great thing was to get the happy medium, and do away with both naphthalene and condensed oil. If Mr. Benyon was going to try two portions of his washer for the oil to take out the naphthalene, he could only say that he had tried it, and had not been successful. He did not find it did the least good. If he was to do it successfully, it must have an appliance to itself. In reply to a question put to him by the President, Mr. Chapman said the solvent he had used in the washer was green oil.

Mr. Thomas Glover (Norwich) said he had recently had a little experience with water gas; and although there was some difference as compared with the time when coal alone was carbonized, at Norwich the naphthalene trouble still existed to a considerable degree in the summer months, in spite of the fact that they were using 30 to 40 per cent. of water gas. There was a great deal in what Mr. Chapman said, that it was a question of the temperatures employed in the carbonization of the oil. If it was split up at a low temperature, or if a proportion was split up at a low temperature, there would be very little trouble from naphthalene; but if the highest results were expected from the oil, the naphthalene trouble would exist. With regard to the use of benzol as a solvent, they must remember that they could not use benzol for dissolving out naphthalene without running the risk of increasing the illuminating power to an undesirable degree. It would not dissolve out naphthalene unless it was in the liquid form in the mains, or some apparatus was provided for it; and the gas would take up so much benzol vapour as to render it quite smoky. With regard to the other two solvents, a very interesting paper was contributed to one of the German Societies by Dr. Eitner, or Dr. Bunte; but there xylene, as they call it in Germany, or xylol, as it was called in England, was advocated very strongly. Mr. Smith had xylol in his table as dissolving 31·5 parts, which showed it to be an extremely good solvent; but on inquiry into the question at the time, he found that tar distillers in this country could not supply it at less than 5s. a gallon, which put it out of the running altogether. A very good solvent was Scotch blast-furnace oil. It was not so good as xylol; but it cost only 1d. a gallon or thereabouts. If this were vaporized in the apparatus suggested in papers read by himself and others, it would bring about the desired results. Mr. Smith had not made it quite plain how he proposed to use these solvents, whether for local stoppages or on a large scale at the gas-works; and he did not give the quantities he would vaporize if that were his intention. He did not know whether he proposed to flush the mains or the services with these solvents, or to volatilize them as he and others had advocated. From light spirits, such as benzol, no relief could be expected so long as they were in the state of vapour. They must be in the form of liquids before they acted as solvents.

Mr. C. F. Botley (Hastings) said this paper, for the most part, confirmed some experiments and conclusions that he came to five or six years ago, as stated in a paper which was prepared by himself jointly with his father in 1897; and many of the conclusions now set forth would be found to be included there. As regard the carburetted water gas, it was another case like that of horizontal and inclined retorts—there was a great variety of opinion about it. Many people never had naphthalene in any quantity until they used water gas. On the other hand, he had been told, and had every reason to believe it, that others introduced water gas and found their trouble with naphthalene was gone. He always attributed this to the high percentage used, and the way in which the water gas was made. There were two extremes of heat in water-gas manufacture—the high and the low. In the low, one made an immense amount of condensed oil, which seemed to dissolve out the naphthalene. On the other hand, if one went very high, naphthalene was produced; but it would be found difficult to get this high temperature, and one could make a permanent gas without naphthalene. But still, in this condition, it would not prevent the coal gas throwing naphthalene down. In the second paragraph of the paper, the author was no doubt referring to particular solvents; but he could not let it pass as it stood. It had fallen to his lot to devise a method by which naphthalene was obviated; but neither of the solvents mentioned was used. He found that using benzol, for the very reason Mr. Smith had pointed out—namely, that it was volatil at ordinary temperatures—was no use in preventing the formation or deposition of naphthalene. Consequently, he turned to an oil which was non-volatile at ordinary temperatures; and with this he succeeded. He used American petroleum. It was not vaporized, but mechanically formed into a mist; and its solvent power was only 5 or 6 parts in a hundred. At the time he prepared the paper on carburation, he went into the solubility of naphthalene in various oils. He took only three—benzol, American petroleum, and coal-tar naphtha; but he ignored the temperature element to which the author had called attention. He took

these at the natural temperature prevailing at the time, and did not get anything like the solvent power, either for benzol or the other oils, which the author obtained. Perhaps this was a matter of no consequence, except as showing what influence the temperature had upon the power of these various solvents. Benzol was used in some places, and was said to be effective in preventing naphthalene; but he did not think, in places where naphthalene existed in the summer time, it had ever been found possible to prevent trouble with it by the use of benzol, because it became volatile, and in this condition passed away as vapour and had no effect on the deposits. After quoting a passage from his paper of 1897, Mr. Botley said any volatile oil at a certain definite temperature had a certain vapour tension; and gas carburetted with petroleum vapour had been proved over and over again to be capable of absorbing and carrying away 20 per cent. more naphthalene than would benzol at the same temperature.

Mr. Samuel Glover (St. Helens) said he had been studying this subject along with others for some years now; and naturally he was much interested on seeing the title of the paper, and was anxious if possible to learn something new. He had some difficulty, however, in realizing what was intended to be taught by it, and also in accepting some of the assertions. The author said: "While the introduction of solvents to the street-mains seldom produces the desired results;" but he (Mr. Glover) submitted that it was well known that the proper sort of solvents produced very quickly the desired results. He therefore combatted this statement altogether. Again, the author said: "Though many solvents have from time to time been proposed, information as to the most suitable material to employ is decidedly scarce." It seemed to him there were other creatures in the world than the ostrich which hid its head, and professed that there was no knowledge. The paper was very vague indeed as to how the solvents were to be used—whether along with the service force-pump or how, there was no indication whatever. And after asserting that the solvents had no power to dissolve, the author went on to recommend—and this was the only valuable recommendation in the paper—the use of a solvent which he considered the best. It was only justice to the Institution to say that it had had presented to it definite knowledge on this subject years ago, which was published in the "Transactions;" and blast-furnace oil had been recognized for a long time as being a most potent solvent for naphthalene. If it were properly used in the distributing mains, and diffused into the gas at the works, it had a great influence on the naphthalene remaining in the gas. On the other hand, the discussion showed there was a little mixing up of ideas as to the influence of washing or scrubbing oils, and oils suitable as solvents for vaporizing into gas. These two processes should be distinguished from each other. Oils which were (from the fact that they contained some naphthalene) not suitable for vaporization as solvents for naphthalene, were still very useful for the washing of oils, because, though they had some naphthalene in them, they were not saturated. The influence of the washing of the gas which was being made could not be expected, as Mr. Chapman seemed to think, to have an immediate influence in remedying the trouble with his district, because the trouble at the time was caused, not by the gas he was then washing, but the gas which he possibly had made some months before and stored in his holder, and having deposited naphthalene in one place the naphthalene would afterwards be carried away and affect the gas on the district for some time. If Mr. Chapman had continued the experiment, he would have found that turning out the gas denuded of naphthalene it would pick up a little, and continue to do so, and carry it forward, and so cleanse the mains. The washing of gas containing naphthalene in suitable oils was well known to be a success; and information about it was in possession of the Institution.

Mr. E. A. Harman (Huddersfield) said he must express his appreciation of this interesting paper, because any contribution on the subject he regarded as most valuable, especially when put in presentable and condensed form. Mr. Smith had not gone into the engineering side of the question, but had dealt with it from the chemist's aspect. He had not told them where to put the solvent, or when; but they could put it when and where they liked. He had not dealt with the matter from the economical nor the commercial point of view; neither had he dealt with the question of market prices. It was left open entirely to the experience of the members themselves to apply in any way that seemed suitable or desirable. He was sure he only expressed the feeling of many others in saying they were exceedingly indebted to Mr. Smith for his valuable paper. The paragraph giving the various solvents, with the table (which must have entailed a large amount of careful work), was alone most interesting and suggestive. It was easily read; but all these figures demanded close and painstaking laboratory work, and they were much indebted to Mr. Smith for them.

The President, before calling on Mr. Smith to reply, said he might be allowed to make one remark. By the observation at the opening of the paper, it was evident that what was intended there was that naphthalene was capable of being produced at a high temperature, whether it existed in water-gas or in coal-gas plant.

Mr. Smith, in reply, said his paper was not intended to instruct engineers how to use solvents, but to point out the value of each solvent with regard to naphthalene. There had been a question raised about water gas being a preventive of naphthalene. It was in some cases; but in a great many others it had not been. A question was also asked as to the temperature at which he found naphthalene formed. It was formed at about 1200° Fahr. and upwards; but if the temperature were brought down about 50° or 100°, one only got about ¼ per cent. of naphthalene in the tars. The solvents, of course, were given just to indicate the power of the oils, not to say whether they should be put in by a force pump or not. It was not for him to instruct engineers how to use solvents. He saw Mr. Botley's tests of solubility; but he was sorry to say he could not quite understand them. It seemed as if he took a certain amount of solvents and naphthalene and weighed them. Besides, at that time there were no means of estimating naphthalene correctly; and he did not go into the same solvents as were referred to in the paper. On the question of price, he could not say the price of blast-furnace oil. The reason he examined it was this: In getting creosote oil from tar-works it was guaranteed to be free from naphthalene at 30° Fahr.; but below this temperature it contained as much as 3 per cent. of naphthalene, which could be removed by steam distillation. With blast-furnace oils, he had not been able, in several samples examined, to find the least trace.

The President said Mr. Livesey would now give them a lecture on the evolution of the gasholder; and it was the wish of Mr. Livesey that his remarks should be open to discussion, just in the same way as if he had prepared a written paper.

A TALK ON THE DEVELOPMENT OF THE GASHOLDER.

By George Livesey.

Mr. President and Gentlemen,—This talk of mine is simply a stop-gap. I was asked, when there was a danger of one of two of the papers failing, which happily did not fail, if I would give a paper. I said I really could not do anything of the kind—I was too busy to write one; but it had occurred to me to have something to say on the development of the gasholder. This was brought about by reading the recent admirable address of Mr. Hunt before the Midland Association,* in which I noticed a serious omission with which I shall deal later on. Your President, in introducing the subject, has used the word "evolution" of the gasholder. The word I use is "development," as I cannot understand evolution in connection with it. I cannot understand the gasholder growing out of a shovel, or anything of that kind; but I can understand a man, when the necessity arises for something new, devising something to meet that necessity. I can also understand that, as circumstances change, the invention may be developed to a much greater extent than was anticipated by the original contriver of the apparatus.

Now, the gasholder to-day is to all intents and purposes the same in essence and in principle as the first gasholder that was ever made for use in gas-works. The skeleton diagram (No. 5) shows different sizes of gasholders. There is a little one at the bottom which I assume to have been one of the first gasholders that was made; I dare say it is larger than the first. I take the size, it is an imaginary size, as 12 feet diameter by 10 feet high; but I expect the

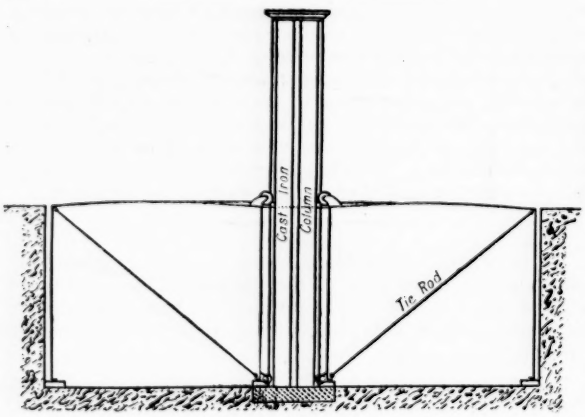
*See *ante*, p. 549.

first gasholder was even smaller than that. The contents of such a holder will be about 1200 cubic feet; and the only difference between that and the largest in existence is that the contents of the largest are about 10,000 times as much as that of the first one that was made—12,000,000 cubic feet, against 1200 cubic feet. The first gasholder, I suppose, was built upon the premises of our friends the Gaslight and Coke Company; and at that time there was no question whatever that they led the world in gasholders and everything else. I do not know when they lost the lead, but they certainly have lost it for a great many years.

The first gasholder I saw was one of the Gaslight and Coke Company's, in 1838. My father was engaged in the works at Brick Lane. I can remember him taking me to the gas-works; but my memory of these gasholders is too hazy for me to venture to say anything about them. But I can go back to 1840. The first gasholder I remember being built was in 1840. I was playing about the tank, and running along the planks one evening; and as I had not got the rhythm of the plank, the next instant I found myself in a puddle at the bottom of the tank, fortunately not hurt. That gasholder cost £35 per 1000 cubic feet capacity; and the last one built by the South Metropolitan Gas Company cost £5 per 1000 cubic feet capacity—a great difference in the matter of price.

I propose to deal with the matter, taking it in decades. I can remember distinctly the gasholders at the Old Kent Road works, built in the thirties. The first was a central guided one (No. 1), of 50 feet diameter and 16 feet deep, holding 30,000 cubic feet of gas. In the centre was a cast-iron column with four ribs, and a cylinder in the centre of

No. 1.] CENTRAL-GUIDED GASHOLDER.



the gasholder with rollers at the top and bottom, and it was surrounded by a brick wall to keep it from the wind. Then came another of the same sort, then another single-lift, holding 40,000 cubic feet, and then another, telescopic, the first of my acquaintance, holding 44,000 cubic feet. This, I believe, was designed by Mr. G. H. Palmer, a well-known gas engineer of that time. It had a timber frame of highly scientific geometrical construction, with timber uprights; but the top beams holding them together were very well contrived indeed. Then came the gasholder I have referred to, which was built in 1840. This had a cast-iron guide framing with tripod standards held together at the top, not by horizontal girders stretching from standard to standard, but by two triangular intersecting systems of girders—the strongest, I suppose, ever seen for a small gasholder, only containing 60,000 or 70,000 cubic feet. The cast-iron frame and the top framing were such that they would almost have held a ship of war from tumbling over.

That is as far as I recollect of the forties; but when we reach the fifties, we come to a striking innovation in the manufacture and construction of gasholders by the late Mr. Croll. I have mentioned the telescopic gasholder. I do not know who was the originator of the telescope, but I think he was the originator of all our large gasholders, for without the principle of telescoping it would have been quite impossible to make gasholders such as we have now. Whoever he was, he was a clever and ingenious fellow, and we owe him a debt of gratitude for his contrivance. Mr. Croll had the idea that too much money was being spent on gasholders, and at his works at Bow Common, for the Great Central Gas Company, and also at Rotherhithe, for the Surrey Consumers' Company, he constructed some very light gasholders about the year 1850, upon which, about five-and-twenty years afterwards, there was an interesting discussion before the old British Association of Gas Managers—Mr. George Anderson taking a prominent part in it with the late Mr. Thomas Hawksley. It was Mr. Hawksley who used the expression "gossamer gasholders" in describing these holders at Bow and Rotherhithe. Mr. Robert Harris said afterwards: "Well, whether you call them gossamers or not, all I can say is they are standing now; nothing has happened to them." They were untrussed; but that was nothing new, because the first gasholders ever built, which were some 10 or 12 feet in diameter, must have been untrussed. Then came trussing and larger diameters; and then Croll went to considerable diameters without trussing. Moreover, the guide-framing was of a very light character indeed; and these gasholders stood, and stood well. They may be standing now; one at the Surrey works was standing until quite recently—a three-lift, of 80 feet diameter by about 12 feet deep, which we converted into a five-lift, deepening the tank and making it about 80 feet high.

Up to this time I do not know where the largest gasholder was. The largest one I can remember was in 1854—I can go back to that year. I remember going to see the gasholder built by the late Mr. William Innes, the Engineer of the Phœnix Gas Company, at their Kennington station. That station had been the property of the Southwark and Vauxhall Water Company, where their reservoirs were placed. The Gas Company bought the land, and, I believe, put a gasholder in one of the reservoirs. I am not sure whether the holder that Innes built was not the one. [Mr. CARPENTER said it was.] It contained 1,400,000 cubic feet, and was the largest gasholder of its time, and without any internal trussing. It was 160 feet in diameter by 35 feet deep, and had two lifts. Innes adopted a very singular method of guiding it. Instead of the ordinary cast-iron columns, he made a column of thick boiler plate riveted up, and fixed it at the bottom by an angle-iron flange; bolted to a cast-iron plate, and covered over with a sham moulding at the base. Then at the top he just connected them by tie rods. In the eighties, after the amalgamation with the South Metropolitan Company, we felt uncomfortable about these columns, and put girders upon them. But the fact that such columns on so unstable a base held as they did for thirty years in a prominent position, exposed to all sorts of winds, without any mishap of any kind occurring, seems to indicate that very little is necessary to keep a deep gasholder in its place, and proves, moreover, that the direction in which some had been going was quite mistaken, in building these enormously strong guide-framings. In 1854, that was the largest gasholder in existence.

Then we come to about the year 1860, when the late Mr. Robert Jones came on the scene. He was the first to build a holder containing about 2 million cubic feet. He put up two—one at the Commercial works, where he was Engineer, and one at the new London works, where he was Consulting Engineer. The one at Nine Elms is there still—a two-lift gasholder; but the one at Stepney has been converted into a three-lift, making the capacity 3 million cubic feet. The father of our friend here who gave us a paper yesterday [Mr. Jones], was the man to take the lead in building two million gasholders, as the son has also been a pioneer in light guide-framing. The next step in size was made by Mr. Thomas Kirkham, at Fulham; and that holder is there now, with a very highly ornate framing, with cast-iron columns and girders, with spandrels filled up with a lot of tracery. The contents of that holder are about 2,600,000 cubic feet.

Then we come to the seventies; and here the honour must be given to our friend Mr. Corbet Woodall, who built a large holder at Kennington in 1878—contents about 3,100,000 cubic feet. I think this holder is 218 feet in diameter and 45 feet deep. It has been since converted into a four-lift holder, and the capacity has been raised to 6 millions. In that holder we have wrought-iron framing—a sort of tripod standard and lattice girders. Then came the holder in the Old Kent Road, which went to 5,500,000 cubic feet in 1881, and in which was adopted more than had been done before the diagonal braced system of framing. The diameter is 214 feet, the depth 53 ft. 6 in., without internal trussing.

Now I come to Mr. Hunt's omission in his address to the Midland Association. In speaking of gasholders, he did not say one word about that pair of handsome structures which

he put up at Birmingham, capable of containing 6 million cubic feet each, in which there was a great deal of originality of design, particularly in the standards, which are exceptionally graceful and strong, with double columns. Mr. Hunt then had the lead as the constructor of the largest gasholder in the world. After that the next step was to 8 million cubic feet, at East Greenwich in 1887. That is a four-lift holder, 240 feet in diameter and 45 feet deep, with a very expensive tank. The ground was full of water, and a great deal of pumping was required. The cost of the Old Kent Road holder (the 5½ million one) was about £9 per 1000 cubic feet capacity; and in the case of the 8 million holder the price was reduced to only £8, owing to the expensiveness of the tank.

I ought to have said that Mr. Corbet Woodall's great holder at Kennington was built without internal trussing. It was one of the largest. Mr. Jones's at Stepney was practically without trussing; but Mr. Woodall's was entirely without it, with a fixed timber frame within the tank. The 8 million cubic feet holder at East Greenwich, as I said, cost £8 per 1000 cubic feet capacity, and also is without trussing.

About 1887 the first holder to rise above the guide-framing was tried—a two-lift was converted into a three-lift at Rotherhithe without adding to the guide-framing. Several large holders have been built by the Chartered and others, one of the most notable being an 8¼ million feet holder, at present the second largest, by Mr. Hack, at Birmingham, with top lifts rising above the framing, and Mr. Foulis is now building an 8½ million cubic feet holder at his new works at Provan. There remains the 12 million feet holder at East Greenwich, finished in 1887, with six lifts, and a shallow tank, 300 feet in diameter by 30 feet in depth. Here I should like to say a word with reference to my brother. It was his idea to construct this shallow tank. The first tank at East Greenwich had been so expensive that it occurred to him that it would be a great saving if we could build one without pumping. We adopted the idea, excavating down as far as the water would allow—in fact, until we reached the water—and made up the height above ground. So we have there a tank only 30 feet deep for a holder 300 feet in diameter. But to meet this difficulty, we had to devise a special system of guide-rollers for the inner lift, to prevent it tilting. We combined the English and the French systems—the English radial with the French tangential rollers, top and bottom, and with that we have succeeded in making it safe for filling and emptying the top lift. I am not so very sure whether it would not be better, to make perfectly sure with these very shallow holders to adopt Pease's wire-rope guiding as well as rollers for the top or inner lifts.

Now we come to one or two other points about gasholders. The first thing is with regard to the framing. I believe the old builders of gasholders were mortally afraid of going up in height; and you can see at some of the old works, as I have seen, single-lift holders with these enormously strong tripods used as guides. They all seem to have an idea that it was dangerous to go high; and I believe this was why preference was given to the single lift. He who first introduced the telescopic holder was a bold man. The most notable advance in telescopic holder building was made by the late Mr. William Mann—I am afraid my friends do not remember him. He was Engineer of the old City of London Gas Company, and was universally respected. He was a man of whom I never heard a single word of disparagement. When he was Engineer of the Company's works at Blackfriars, he was very much cramped for room, and there was nothing for it but to go up. He then built a three-lift holder, and it was one of the finest objects to be seen on the left-hand side when crossing over Blackfriars Bridge. It was 100 feet high, 84 feet in diameter, had three lifts of something over 30 feet each, and stood in an iron tank somewhat above the ground. The columns I think were double, in three tiers, with a sort of entablature uniting them, and three horizontal girders.* Here the system of diagonal bracing was introduced in a scientific and thorough manner; and it is the first instance I ever recollect of its being so used. That was some time in the sixties. It was introduced in order to make it safe in going to such an unwonted height as 100 feet. That, I consider, was a most important step in the construction of telescopic gasholders.

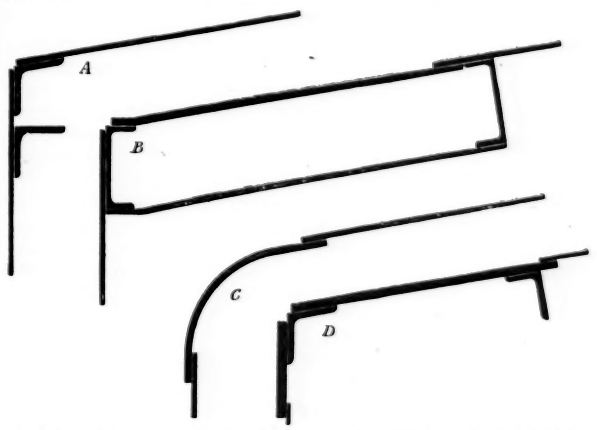
* A view of the holder was given as a frontispiece to Vol. XXVI. of the "JOURNAL."—ED. J.G.L.

Mr. MAY: That framing, it may be interesting to you to know, was re-erected at Calcutta.

Mr. LIVESEY: It had three cross girders to keep the frame rigid, and take the pull of the balance-weights. It had three chains at different parts of the holder attached to one weight to keep the inner lift level. I think it had also balance-weights for the outer lifts, because in the early days it was the great object to have as little pressure as possible. Gasholders were made light and of relatively large diameter consequently giving very little pressure, for down to 1850 there were no exhausters. Then, when they came to adopt the telescopic method, they had balance-weights to balance the outer lifts as well as a weight attached at three points to keep the top level. They seem to have been very much afraid of going up; but, at any rate, we have got past that fear now. That is really a development resulting from the necessity of increasing the capacity and cheapening the cost to meet the enormous advance in gas production.

The first curb was a single angle-iron, with a flat top. When you come to trussing, they put in a couple of angle-irons, and a bolt between the two carried the trussing (Diagram No. 2). Mr. Hawksley said that an untrussed holder was like a wheel without the spokes—that was his expression; the trussing tended to keep the thing in a true circle. When trussing was done away with, it was considered necessary to make the curbs considerably stronger, and the box-girder system was introduced. Then curved thick plates were tried. Mr. Woodall adopted a simpler form for his Kennington holder, and at about the same time it was adopted at the Old Kent Road. I was led to it by

No. 2.] TOP CURBS OF GASHOLDERS.



A. Trussed Crown. B. Box Girder. C. Curved. D. Thick Plate.

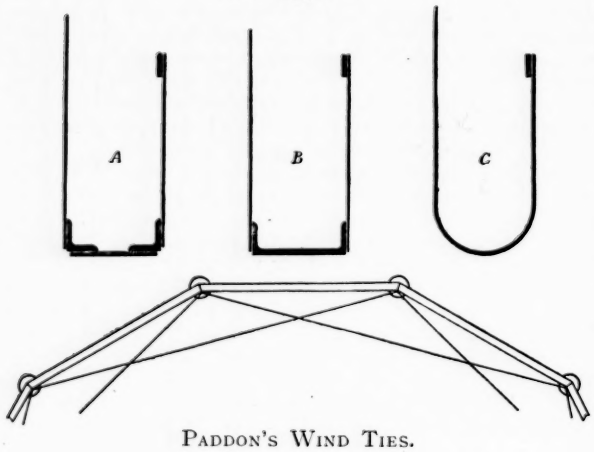
visiting a gas-works—I think at King's Cross—and noticing an untrussed crown, where the outer crown plate was buckled into a series of little hills and valleys running from the circumference towards the centre, and giving an idea that the curb had given way to compression. That led me to think that if the plate could be kept rigid and true, we should greatly increase the strength of the curb. Others, I suppose, came to the same conclusion, and fixed an angle-iron to the underside of the outer thick plate, thus making it a useful member of the curb and simplifying its construction.

Then another of the greatest improvements ever made in gasholders was Piggott's cup. It very frequently happened that leakage took place between the rivets (Diagram No. 3, A); and it was common experience of gasmen in those days to have to repair the cup. The thing had to be hoisted out of the tank, and there was no end of trouble to repair it. Then Mabon, of Manchester, obtained a patent for using channelled iron for the cup (No. 3, B), Horton used it, and there was a lawsuit between them at Manchester, in the year 1862, on the question. George Piggott, the engineering member of the firm, a son of the late Thomas Piggott, was present at the trial, and while he was there the idea occurred to him to bend the plate. In 1862 they had a contract with the South Metropolitan Company for building a gasholder. It was let, and the work was in progress, when they came to us and said: "Will you let us try this form of cup?" We consented; and Piggott's cup was put into the gasholder in 1862. It is at work now, and there never has been any trouble with it. I therefore think that one of the greatest improvements ever made in the matter of gasholders was

the invention, by the late George Piggott, of this cup, which is now in universal use.

As to the framing, I may mention that Mr. John Paddon introduced the arrangement shown on Diagram No. 3 at Brighton, or rather, at Hove. As he built his gasholders to a considerable height, and they were exposed to gales, being near the sea, he put in trusses so as to give rigidity to the top of the frame, which it certainly would not have without

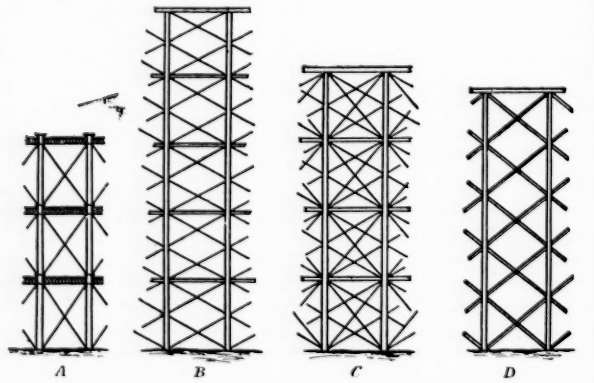
No. 3.] GASHOLDER CUPS: A. Old form. B. Mabon's. C. Piggott's.



PADDON'S WIND TIES.

it. And here I might say a word about the girders. It was a very common practice in the early days of the introduction of lattice girders to try to ornament them, and put rosettes at the junctions of the lattices. These rosettes harboured rust, and it was impossible to paint or do anything under them. I had them all taken off, so as to have the iron of the girders get-at-able. While I am on the subject of ornament, I may tell you a little story of my late friend Major Dresser, of the "American Gaslight Journal." One day, when we had got the large gasholder in the Old Kent Road nearly finished, he paid me a visit; our late friend John Somerville was experimenting at the time with ornamental finials to the standards. He made them of different shapes, and had one on the top of this standard and another of a different shape on the top of the next. Major Dresser looked up and said: "What on earth are those things?" "Well," I said, "they are intended for ornament." "Ornament?" said he, "you have not got a particle of ornament about the gasholder; do not spoil it by putting those monstrosities up there." We have followed his advice, and have never since tried to put anything in the shape of ornament upon a holder.

No. 4.] TYPES OF GUIDE-FRAMING.



A. Blackfriars Holder. B. Old Kent Road Holder. C. East Greenwich Holder, 1887. D. East Greenwich Holder, 1897.

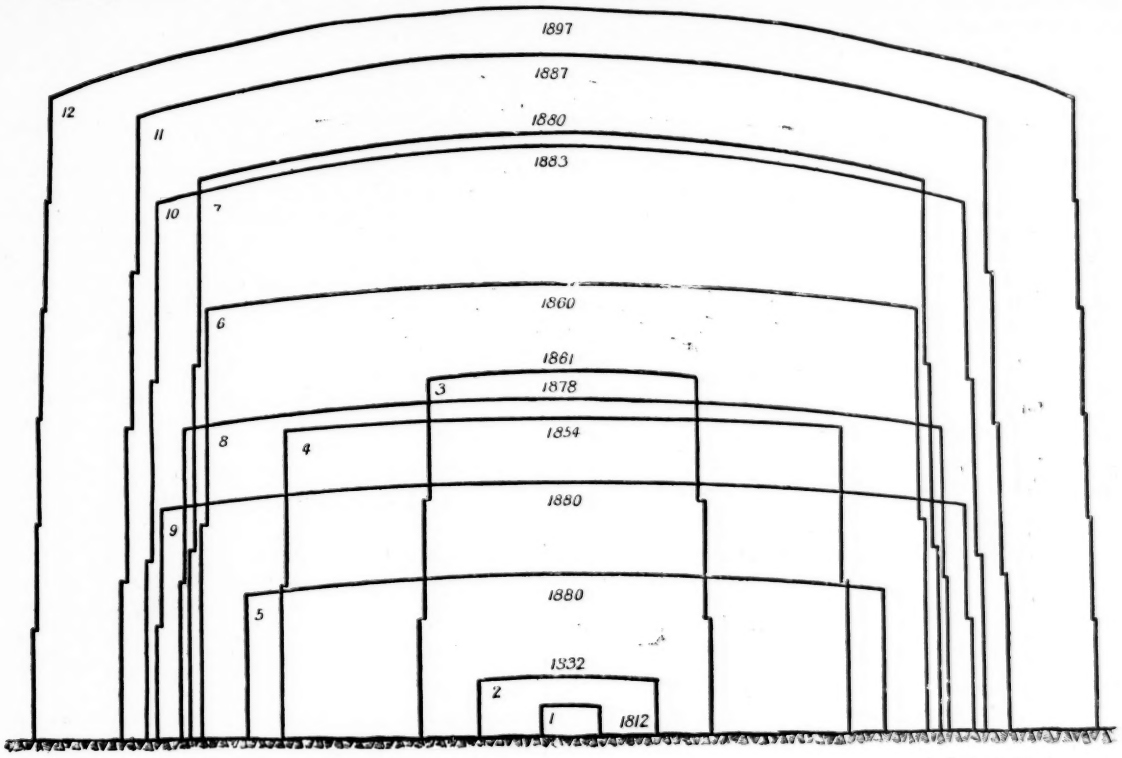
The reason I prefer plate girders to lattice girders is that the things have to last forty or fifty years; and I think a plate girder is less likely to rust, and is more get-at-able for the purpose of painting, than the lattice girder. Fig. A in Diagram No. 4 is Mann's framing; fig. B is the 5 million holder in the Old Kent Road, with double diagonal bracing; and fig. C the 8 million gasholder at East Greenwich, with triple diagonal bracing. But there it is overdone. We put in the double bracing like fig. B, and then consulted an eminent Engineer, who said: "Well, I am not quite sure about it; but it might be wise to put in a little more." Accordingly, in addition to this double bracing, we put in a third, so that it looks a perfect network of bracing. The trouble with this system was that there was difficulty in getting the flat bars properly adjusted; and when we built this holder we made up our minds we never would have any more with ties. The next was the 12 million holder at East Greenwich, in which two lifts go above the framing, and there is diagonal bracing consisting of struts only (fig. D, No. 4). We have no cross girders except at the top. We have a small one at Rotherhithe with two lifts going out also. I believe it is perfectly safe for a gasholder to have one-third or two-fifths of its height above the framing; but I should not like to build one with half its height above. It seems to throw too much strain on the rollers and bearing parts.

I must not forget to mention here various men, and among the rest Mr. Webber, who, in the eighties, took a very prominent and a very useful part in gasholder building, and who was, I believe, in favour of almost doing away with the framing. Then came Gadd and Mason with their very clever invention of a spiral guide without external framing. Then came Pease with an equally clever invention of a wire-rope guiding. It cannot be disputed that both of these systems were successful. But my objection to them is that the stress of the wind coming on the gasholder must be carried to the ground in some way; and I contend that it is better that the stress or pressure should be carried independently of the holder. If it is not carried to the ground by the framing, when there is no frame it must be carried to the ground by the sheeting; and this I think, would impose a strain on it which it ought not to bear. *A propos* of this, I may mention that when I was quite young one thing puzzled me very much—viz., that the sides of the gasholder seemed to remain sound when the crown became leaky and worn out. I said to myself: "Well, here is a funny thing. Here are the sides going in and out of the water every day, and they keep all right, yet the crown, never going into the water at all, becomes leaky, and has to be patched." I think the explanation is that whereas the sides have no work to do, the crown has a great deal, and is constantly changing. When it is down, it is not in tension at all; when it is lifted, there is a certain tension which comes on the plates. When it takes on the second lift, there is a greater tension; and so on—a constantly varying tension, which seems to me one of the causes why the crown gives way more than the sides.

Then as to the systems of guiding. The English system always was to have radial rollers; the French system, simply to have tangential rollers. I first saw them in Paris in the seventies. When we built the 5 million cubic feet holder in the Old Kent Road, we combined the tangential and the radial. But there is a difficulty in projecting the tangential rollers so far from the holder. If you put them on the side, it is all right; but for your top carriages you cannot do it, and it is rather weak. Then we contrived an angular system. I must say I think the tangential is better than the radial, because it gives double bearing points in a holder, especially when applied as the French do it. You have twice as many bearing points in the tangential system as in the radial; and our angular system is something betwixt and between, in which we have found advantages.

With regard to accidents to gasholders, I think I may say that the mishaps and difficulties we have with them are much less now that we have gone to these enormous sizes than they were in the past with the small sizes. It used to be the practice to load holders so as to give the necessary pressure; and I well remember one which was loaded with mouthpieces all round the top, which made it top-heavy. The holder tilted, as it might naturally have been expected to do. They sent for the Company's consulting engineer—the late Mr. John Kirkham, who was of Pickwickian build, and he got a lot of the stokers on to the holder to drag the mouthpieces from one side to the other. While they were dragging them across, the holder suddenly tilted to the other side, and shot the mouthpieces, the stokers, and the consulting engineer on to the ground. We are spared these difficulties now. I once saw a gasholder on fire—the one in the Old Kent Road with the wooden framing. One morning they found that something had happened to it in the night. They attempted to repair it, and brought a light or a red-hot iron, or something of the kind near it, and it ignited; and I can remember distinctly a long flame of fire coming out of the

No. 5.] TYPES OF GASHOLDERS.



	Contents in Cubic Feet.	Date.
No. 1.—Imaginary Chartered Holder*	1,200	about 1812
No. 2.—First South Metropolitan Holder*	30,000	1832
No. 3.—William Mann's Three-Lift Holder, Blackfriars*	†	1861
No. 4.—William Innis's Kennington Holder	1,250,000	1854
No. 5.—F. J. Evans's Single Lift 180 ft. by 40 ft. Beckton Holder*	1,000,000	about 1870
No. 6.—Robert Jones's Stepney and Nine Elms Holders	2,000,000	about 1860
No. 7.—Old Kent Road Three-Lift Holder	5,500,000	1881
No. 8.—Corbet Woodall's Two-Lift Kennington Holder	3,100,000	1878
No. 9.—Gaslight and Coke Company, Fulham Holder	2,600,000	1880
No. 10.—Charles Hunt's Three-Lift Birmingham Holder	6,000,000	1883
No. 11.—East Greenwich Four-Lift Holder	8,000,000	1887
No. 12.—East Greenwich Six-Lift (Two Free) Holder	12,000,000	1897

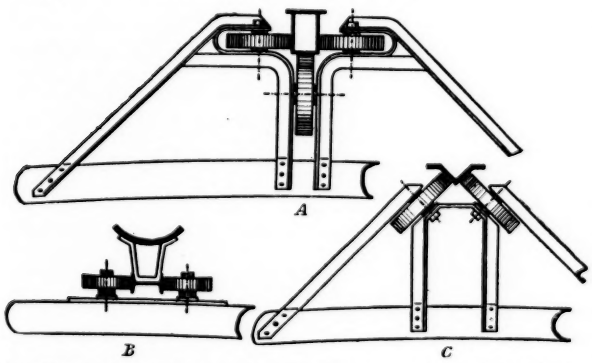
* Nos. 1, 2, 3, and 5 are not in the series of largest gasholders.

† No absolute record can be found of the capacity of this holder; but it may be pointed out that the lowest lift was 82 feet, the second 80 feet, and the third 78 feet in diameter, while the holder rose to a height of 98 feet.

crown. But to be quite sure about my recollections; the other day I asked an old pensioner who worked with us at the time, and he said he remembered it quite well. It just burnt itself out, in accordance with my recollection—I was then about ten years old. They simply had to look at it until it sank into the tank, and no harm resulted.

I am afraid this random talk has been very unorthodox;

No. 6.] TYPES OF GUIDE ROLLERS.



A. Radial and Tangential. B. French Plan. C. Radial and French Combined.

but I thought it might be of interest to have on record the names of the men who have done great things in gasholder building in past times. Most of us are passing away, and there are very few of the old one's left—I am afraid I am almost the only one left whose recollections goes back to the forties. It is a pity we could not get records of the time before 1840. I do not know who built the first million feet holder. I thank you very much for the kind attention you have given me.

Discussion.

The PRESIDENT said he was sure they were all struck by the admirable way in which Mr. Livesey had been able to give this historical *resumé* of gasholder construction with which few, if any, gas engineers were so familiar as he was. His memory was sufficiently well stored with the facts to enable him to recall them without notes; and they would all appreciate very highly his kindness in coming to give them. If anyone could add anything to this history, it would be welcome.

Mr. W. H. Y. WEBBER (London) said it was a very great pleasure to him to hear this talk about gasholders, from one whom they all acknowledged to be one of the greatest living masters of the art of gasholder construction. But what Mr. Livesey had not said, chiefly about his own work in the matter, was almost as interesting as what he did say. There were a great many points which he (Mr. Webber) had to pass over very lightly; and he was afraid at that hour he could not possibly hope to touch upon them. But he might claim to have had some years' work upon gasholders; and if the meeting would bear with him for a minute or two, he would try to add a little to what Mr. Livesey had said. He should not have intruded but for the fact that, if he was a specialist in anything—at any rate, some years ago—it was in gasholders. There was just one point about the rollers which Mr. Livesey did not mention, and he did not know that it had ever been stated in print; but it was as well to put it on record. The great difference between the radial and tangential roller was not only (as Mr. Livesey had said) that the tangential system would get twice the number of points of bearing, but there was also this difference, that however much the curb might be deformed, the tangential roller was not really thrown out of

service. But with the radial roller it was the exact opposite. When the gasholder was blown up for the first time, the radial rollers could never be screwed up to their work. It was necessary to wait until the inner end of every carriage was tilted up by the pressure coming on the crown, in order to see how tight the bearing was going to be; and then—but very gingerly and very tentatively—the roller had to be brought up to its work. With tangential rollers, if the guides were only made wide enough it did not matter. One could adjust them, and then blow up the holder as hard as one liked. If the curb or crown responded by an alteration of form, it simply shifted the roller a little further away, and no harm was done. He would undertake to say that nobody ever measured with a tape a 200-feet gasholder crown, and made it on two different days the same dimension across. The great work done by the crown had been mentioned by Mr. Livesey; and it was quite true that the material of the crown got tired very much sooner than that of the sides, because it had so much more to do. It not only had to carry the whole structure, but it bore a lot more of the strain of the pressure of the gas than any other part of the holder; and, what was much more important, it had to bear almost the whole of the expansion and contraction due to sun and frost. He remembered one of his experiences was when they had a dreadful squabble about a gasholder crown which was very wobbly. The Committee came down and walked across it, and could hardly keep their feet, the crown wobbled about so much—being all hills and vales. They were very much annoyed, and requested that he should see to the matter. Of course, he said it should have attention, though the holder was quite right; but they would not believe it. However, he made an appointment for 10 o'clock in the morning to meet the Chairman, to come and see it. It happened to be a frosty night. The Committee came sharp at 10 o'clock, and walked over the crown; and it was as tight as possible. They were all of them perfectly satisfied, although not a stroke had been done on the dome in the meantime. This would show the enormous amount of strain that went on upon the crown of a holder. There was a superstition about cutting the sheets of the crown like the spokes of a fan; but this was a very irrational idea. It only showed how conventions lasted. It was practised for many years, without the remotest reason for it. There was a large round plate in the middle, called the centre plate, which was pretty stout; and then they had fine tracery radiating from it, the sheets of the first row of the crown being perhaps not more than 3 or 3½ inches wide at the inside. Mr. Livesey had not taken the credit which he might have done, for the very common-sense idea of laying the crown of a holder just like the wood paving in a road, letting the outside edges come where they might, and having them punched in place and put together; when it was found that one got no unequal strains. Mr. Livesey did not mention that the oldest holders were put in houses; and when he first went into gas (which was at the Exeter Gas-Works in 1867), they still had there two little old holders in a very beautifully-built brick house. They were about 20 feet in diameter; and they rose inside the house entirely. Often since he had wondered whether it was wholly for the best that the gasholder-house had disappeared from English practice. Of course there were degrees; but when they saw what beautiful work was done in North Germany, when the Institution went to Berlin—when they saw what they did in the way of gasholder-houses there, it would be recognized by a good many that erecting gasholders in houses had a good deal to be said for it. He was not so sure the wide alternations of heat and cold which gas had to undergo in an exposed gasholder had not something to do with the terrible subject they had been discussing that morning (naphthalene). He had suggested that a barrel or two of petroleum put in on the top of the water might perhaps help in keeping the gas dry. There was one point which he had brought out before in speaking on this subject, which he took considerable pride in—namely, that he was responsible chiefly for drawing attention to the vast importance of the bottom guiding of the gasholder; and he was of opinion that the whole of the modern advances by Gadd and Mason, and Pease, in discarding to a great extent the use of outside framing, and Mr. Livesey's own practice, proceeded from a recognition of the cardinal importance of the bottom guides of a gasholder as being of far greater consideration really than the top. If they once got the bottom rollers right and accurate, and as rigid as possible, and jammed as tight as practicable, then the holder was safe. It was a curious thing how the telescope form, which Mr. Livesey said was a grand invention, at one time almost went out of fashion. He believed in the early days some of the standard text-books spoke a little disparagingly of there having been such things made as three-lift holders, but that they were going out of use; and so forth. There, again, the past sometimes had more leading in it than the present. Now multiple lifts were coming in again everywhere; and the limitation of the number was only a matter of commonsense. The greatest further modern improvement he thought they could look for in the gasholder was the standardizing of the scantlings, and the leaving of no holes and gaps where rust could take hold. Their Continental friends were exceedingly clever engineers, and he had observed many of their triumphs in gasholder construction; but there was a finikiness, if he might use the term, about some of their types of gasholder construction—a certain amount of embroidery, some of them looking as if the guide framings were cut out with a pair of scissors and put together—which was not like the sound English practice. Of course, it should hardly be necessary to say—but one must sometimes say the obvious—that one should never put ironwork together where the paint brush could not go, and should use simple, ordinary, commercial scantlings and plates. This being the case, with good stuff not stinted in the way either of the sheeting or the standing work, a modern gasholder was certainly, not only in size, but also in quality, a very great improvement on the old; and he thought the gasholder engineering of the end of the last century and the beginning of the present was a thing of which the gas industry of this country might on the whole be honourably proud.

Mr. Charles Hunt (Birmingham) said he should like to add his testimony to the very interesting character of the account which Mr. Livesey had given of the development of the art of gasholder construction of which he was the master, and with regard to which probably no man living had a more extended recollection. Mr. Livesey had followed up the development from the very smallest gasholders, and had shown how the gradual enlargement of these structures had taken place. Mr. Livesey had referred to Piggott's cup as being one of the greatest modern improvements, and no doubt that was so. But he thought the improvement which had led most to the development of large gasholders was that with which Mr. Livesey himself had been chiefly identified—the abolition of the internal trussing. The first really large gasholder which was built without trussing was that at Kennington Lane. It was true that the gasholders referred to, built by Mr. Jones, had very light trussing; but he thought that Mr. Woodall's was the first large gasholder in which the trussing was designedly dispensed with. At any rate, this was a most important step in the direction of the abolition of trussing, and one which led up to the development of the curb, by which alone it became practicable to greatly increase the size of gasholders. Mr. Livesey had kindly referred to the two gasholders he (Mr. Hunt) built in 1883. He need hardly say that in all likelihood they would not have been in existence, had it not been for Mr. Livesey's holder of 1880. This happened to be at work during the somewhat remarkable Gas Exhibition at the Crystal Palace, which his Committee visited; and he took advantage of the opportunity to show them, by Mr. Livesey's consent, the largest gasholder in existence. This gave them confidence to go a step further; without such an object-lesson, it was doubtful if permission would have been given him to proceed. With regard to tangential rollers, he was not altogether clear that in time to come they would be regarded as necessary. As the curb was sufficiently strengthened to resist the strain placed upon it, there was much less risk of the crown getting out of shape—to which Mr. Webber had referred—than formerly. A trussed crown would get out of shape much more than an untrussed one. His observation of the holders referred to was that there was very little variation indeed when they began to take the weight—in fact, nothing perceptible; and this led him to doubt whether the tangential rollers were altogether so desirable as they appeared. With regard to the more recent developments—the Gadd and Mason and the Pease rope-guided holders—were they not both examples of the strain being transmitted to the ground, although not exactly in the manner ordinarily understood? In the case of Gadd and Mason, the guides of the holder took the strain; and they were anchored. The same might also be said of the Pease ropes, which were anchored to the ground, though with a flexible hold, which was a disadvantage. He could not help thinking that, as time went on, confidence

in both these systems would increase; and he did not see any real limit to their application. The size of a holder was a question of circumstances, and no doubt would receive much further development as time went on. The one represented by No. 12 was certainly a very bold example, and one which every constructor who contemplated the erection of a gasholder would do well to keep in view, and from which he would derive encouragement to extend the limits of size as occasion required.

Mr. William Foulis (Glasgow) said he had been very much interested in what Mr. Livesey had said as to the past history of gasholders. His recollection did not go quite so far back; but he might say that when he first went to Glasgow, he had to demolish one or two gasholders which had central guide-columns. These were enclosed in houses. With reference to the guiding of gasholders, he had built one or two large holders, not so large as Mr. Livesey's, but of a fair size—about 280 feet in diameter. These were guided by radial rollers alone. The top curb was made of a strong section, which, he thought, was a wise thing to do in any case. After carefully considering the question in all its bearings, he came to the conclusion that it was not advisable to use tangential rollers. He believed that in such a structure as this—in fact, in all pieces of machinery of whatever kind—every moving part that could be done away with tended to increase the efficiency. If they could with one roller guide the holder efficiently, it was far better to do so, because it was much easier to adjust one roller than three. The holders which he had referred to had now stood for some years, and were perfectly satisfactory. As a result of his experience, he would have no hesitation in constructing larger holders with radial guide-rollers only. He rather differed from Mr. Webber in his ideas about the sheeting of the crown. No doubt, there might be some benefit in using square sheets. But it should always be remembered that they had to cover a dome; and there was no doubt radial sheeting enabled the inner and outer circumference of each ring of sheeting to be made exactly the size it should be, so that the sheets lay naturally on the dome. If they could imagine trying to make it with square plates (say) ½ inch thick, they would see at once that each plate would have to be bent into shape. No one would think of making the egg end of a large boiler of square sheets. He therefore differed from the view that square plating was better than radial plating. The question as to the strain that came on the guide-framing was one which involved many difficulties which it was too late then to go into: but there could be no doubt that it was very much less than was generally supposed.

Mr. William King (Liverpool) said that, as this seemed to be an afternoon of reminiscences, he might be pardoned for alluding to some matters which happened early in the history of gas lighting. Mr. Livesey had referred to a fire at a gas-works; and he might say that the first experience he had at a gas-works was being taken to one of the Liverpool stations in the forties, and seeing the smoking ruins of one of the gasholders and its house. There were two circular gasholders, each about 35 feet in diameter; and two square gasholders, measuring about 40 feet on the side. Each holder was enclosed in a separate building. One of the circular holders caught fire. The gasholder burnt itself quietly out; and he had a distinct remembrance of seeing the smoking embers of the building. He should be glad to learn the date of the earliest telescopic holder. The first telescope holder in Liverpool was erected in 1840, by Joshua Horton, the predecessor of Thomas Piggott. It was some 55 feet in diameter and 20 feet deep in each lift; and others of these dimensions were erected during the forties. As regards water-cups, he made some drawings for the cup B as shown in the diagram on the wall, in connection with the first use of channel iron in the water-cup of a gasholder; and some litigation between the firms of Mabon and Piggott resulted as the consequence of this form of construction. He believed that would be in 1857 or 1858. In the same year came Piggott's cup.

Mr. Livesey said he was sure he was right in saying that Piggott's cup came in the year 1862. The first one ever put up was by the South Metropolitan Company, at Piggott's request.

Mr. King remarked that probably they had the second one at Liverpool. In 1858, his father designed a flat-topped holder, with a strong top curb and no internal trussing. The roof was absolutely flat. This gasholder was 125 feet in diameter, with two 30 feet lifts. With regard to appearances, a gasholder, however well designed and fit for the purpose for which it was intended, was not a beautiful object; and there was no use in attempting to ornament it. In this he quite agreed with his friend the late Major Dresser; but at the same time they need not go out of the way to make them ugly. As to painting, he would not advocate their being painted all the colours of the rainbow; but the use of two colours for the framing and the bell might afford some relief. When building an office for a gas, water, or insurance company, or other public body, the owners were generally ready to spend a little more money than was absolutely necessary, for the sake of improving the appearance of the street or town. So with regard to gasholders. They were often unpleasant objects in a landscape; and he thought gas undertakings were justified if they could do something which would relieve their necessarily ugly appearance. He referred especially to carrying up the framing as far as the height of the gasholder when it was quite full, if only for appearance sake, because he could not conceive anything more ugly than the top lift projecting right out of the frame with the guide-carriages in the air. They were exceedingly ugly; and it would be a very small extra cost to carry the framing to the total height, and would be justified by the improved appearance.

Mr. W. R. Herring (Edinburgh) said the reminiscences of Mr. Livesey and other gentlemen were not only interesting to the younger members, but there was a profit in reflecting upon them. His object in rising was to take advantage of the presence of these men of large experience to draw attention to one or two facts with regard to gasholder construction. First, with reference to the shallow tank. If they looked at the diagram of the largest holder in the world, it had a a tank less in depth than any among those on the diagram; and Mr. Livesey said it worked very satisfactorily. But at the present day, though many large holders were being constructed, they were being made with tanks of comparatively great depth. Why should that be? The depth was mostly one-fifth or one-sixth the diameter; sometimes one-fourth. In the tank he put up at Granton, he followed in the footsteps of Mr. Livesey, but did not go beyond the proportion of 1 to 7.

Mr. Livesey said the shallow tank was only made to save expense.

Mr. Herring said he agreed, and this was his reason for constructing a shallow tank; but there were engineers who still stuck to the depth formerly held to be necessary. There were tanks made within the last seven or eight years which were practically of the ordinary deep construction; and it appeared to him if it were now considered unnecessary, some tangible reason should be given why the old proportions should be followed when the new one had proved quite satisfactory.

Mr. Livesey said he would never put up a gasholder with a depth of only one-tenth of the diameter, if he could help it.

Mr. Herring said the Granton holder worked very satisfactorily with a proportion of one-seventh. With regard to the weight of metal employed in the construction of the floating part of the holder, and the external framing, he had recently compiled a table of comparative weights of gasholders approximating the same size, ranging from 5½ to 8½ million cubic feet capacity. He found that the metal employed in the floating part varied from 1220 to 821 lbs. per 1000 cubic feet of working gasholder capacity. He could understand a variation of 20 to 25 per cent. in the floating and more perishable part of a gasholder. One might choose to have slightly thicker sheeting, to avoid subsequent wear and tear; another would have stiffer framing in the inner lift, particularly if it was to rise above the top guide-framing. But with regard to the weight of the external framing, this he found to vary more than cent. per cent. in holders of similar dimensions—ranging from 264 lbs. to as much as 533 lbs. per 1000 cubic feet of working gasholder capacity. This was surely an extraordinary waste of metal If the unit of 264 lbs. was sufficient—and time had proved this—why was so much metal wasted in other constructions? It was surely metal out of place, and unjustifiable expenditure. He desired to draw the attention of the younger members of the Institution to these important facts—first, with a view to recommending the construction of shallow tanks; and, secondly, the sparing of the metal employed in the construction of their gasholders.

Mr. E. A. Harman (Huddersfield) said he had not intended to speak on this subject; but one name seemed to escape

the notice of Mr. Livesey, who was one of the pioneers in this matter—and that was Mr. Cripps.

Mr. LIVESEY, in reply, said it was quite true that Mr. Cripps had done a great deal; and it was only by an oversight he had not mentioned him. He had very litte further to say, except to thank the meeting for the kindly way in which they had received his remarks. He had intended to have said how much they were indebted to Mr. Cripps for the great help he had given in the construction of large gasholders, and also to Mr. Harry Jones, who was one of the first to introduce the light system of framing. The only other point he need refer to was about the question of cost. The first gasholder with which he was acquainted cost £35 per 1000 cubic feet, and the last £5. The cost got gradually down from £35 to £25, then to £20, £16, and ultimately to £9 and £5. This really brought the cost of gasholders to a bagatelle, because £5 per 1000 cubic feet, divided by 200 as the multiple of the maximum day's make, gave 6d. per 1000 cubic feet in the ordinary way of calculating capital for the gasholders. Now the interest on 6d., at 5 per cent., was 0·3d.; so that large gasholders, if they could be built at this price, added to the capital charges to the extent of a little over ¼d. per 1000 cubic feet. This was the reason and the justification for making these large holders. He appreciated what Mr. Webber and others had said, and quite agreed with the statements about bottom guiding. What they wanted was to keep the bottom level. If they could do this, they were all right. The only reason for using tangential rollers as well as radial in the first gasholder at the Old Kent Road, was that it was going up so high that he wanted to be doubly safe.

Mr. WEBBER suggested that £5 was quite an exceptional price; and it was hardly fair to take it as the standard.

Mr. LIVESEY said that even if they put it at £10 (and that was the outside figure now), it came to about ½d. per 1000 cubic feet for interest on capital for gasholders.

Trials of American Gas Coal in Copenhagen.—Mr. J. C. Freeman, of Copenhagen, has sent to the "Iron and Coal Trades Review" the following report of the results of a trial of American gas coal at the Copenhagen Gas-Works: "This coal was used for 24 hours on March 1, in the production of gas in retort-house No. 1, with the following results: Quantity used, 144·14 tons; gas produced, 1,599,300 cubic feet, or 11,091 cubic feet per ton; illuminating power of gas, 16·52 Hefner units; coke resulting from each ton of coal, 16·37 lbs.; ash in the coke, 7½ per cent. The coal was in large pieces; so that crushing was necessary before using. One should have machinery for the purpose. The coke was firm, substantial, and gave a good heat, but left considerable slag in the fire-box. We consider the coke good for industrial use. In stoves, it burns well, giving off strong heat, but requires good draught. Regarding the residuum of tar and ammoniacal liquor, little can be said from so brief a trial. As compared with English gas coal, in regard to the production of gas, the American coal stands certainly as high as, and in some respects higher than, the very best. The result, as regards the amount of coke, is like that obtained from good English gas coal, but the quality is somewhat higher. This coal must therefore be considered a specially good gas coal." Mr. Freeman adds: "This coal was sold here at 20s. per ton c.i.f. With better shipping arrangements and still larger cargoes, this price can undoubtedly be reduced. Two cargoes of Canadian coal, of 5000 tons each, have just been sold here at 15s. 3d. c.i.f."

Tests for Electrolysis.—Electrolysis tests were made in Copenhagen last year; and they have been reviewed in the "Elektrotechnische Zeitschrift." Measurements were made at night, when no cars were running, and a current, usually of 100 amperes, was sent into the rails at a fixed point from the trolley wire. The resistance per square millimetre and metre length of the cast-iron pipes was found to be 0·83 to 1·02 ohms. A current of 100 amperes was introduced at different points into the rails, and in each case measurements of the current in the rails and in the pipes were made about every 200 metres. With the current entering at one end of the line, the total stray current at a distance of 1080 metres was 14·8 amperes, and of this 7·45 amperes was in the pipes. With the current entering at the middle of the line (total length 1210 metres), the stray current was 10 amperes, and 6 amperes of it was in the pipes. The pipes measured were, for about half distance, a 9-inch water-pipe and a 6-inch gas-pipe, and for the rest of the distance an 18-inch gas-pipe and a 6-inch water-pipe. These were from 1 to 3 metres distant from the rails. When the current was reduced from 100 to 5 amperes, the percentage leaving the rails remained exactly the same, as did also the percentage entering the pipes. The total resistance of the rails in the length of 1210 metres was 0·014 ohm, giving a drop, at 100 amperes, of 1·3 volts. The greatest difference of potential observed between the rails and pipes was 0·74 volt. With cars running, the current in the pipes followed their movements. At one point, the current in a 9-inch water-pipe had a maximum value of 2·5 amperes, with an average of about 0·5 ampere.

ESSAYS AND REVIEWS.

THE CARD INDEX FOR TECHNICAL LITERATURE AND GAS-WORKS MEMORANDA.

PROFESSOR H. Wade Hibbard, of the Cornell University, has rendered the profession of engineering a real service by writing a paper on "Engineering Periodicals and the Card Index," which has been published in "Engineering Record." It begins with an observation that comes straight home to the Editorial Staff of the "JOURNAL," by reason of its truth and point. The writer says that editors of papers, engineering and otherwise, are frequently in receipt of letters running somewhat as follows: "Some months ago, I read an article in your paper, or one like it, bearing upon such-and-such a subject. At the time of reading, I recognized its value. Not only did I think that I had the essential items impressed upon my memory; but I recall making some record in my note book. I am now in urgent need of the information contained in the article; but I can neither find it nor my note—the latter being hidden in a mass of other material. Can you supply me with the reference, and, if possible, send me a copy of the paper? I am willing to pay a good price for it." We might remark on this specimen application, that few inquiries of the kind that reach us are even so explicit. As a rule, the anxious inquirer is far more helpless and vague.

It is not now a question of the mere idle person who writes to ask if we have ever published anything about carburetted water gas, or as to the cost of electric lighting. The inquirer we and Professor Hibbard have in mind is the deserving person who knows exactly the piece of information he requires—say, a particular table in a technical article—but for the life of him cannot remember the title of the article, or where he saw it. Consultation of an ordinary index (even when so elaborate as is published for the "JOURNAL") fails to reveal what is wanted, because all it shows is title and authorship. Even a complete subject-matter index, were such a publication possible, would fail equally, because the object sought is perhaps an incidental statement, illustration, or table, which probably struck the reader in a different way altogether from the author's use of it. How keep the trail of such information? It is one of the pressing problems of professional and student life.

Fortunately, the resources of civilization are equal to the demand. There is an expedient, whereby the reader of a technical book, or a periodical, may get the full value out of his reading, by equipping himself with means for finding again anything that happens to strike his attention as possibly worthy of a second perusal or likely to be of use ultimately. This invention is the "Card Index," which is one of the most useful discoveries of modern times in the field of practical reading, or reading for a purpose. It has the supreme merit of preserving precisely what the user wants at the time, or thinks he may want on a future occasion, in a form best adapted to his professional needs and to his own peculiar tricks of memory and observation. It is perhaps more used in the United States than in this country, although it is rapidly growing in favour with many, including the custodians of popular libraries, who are often asked for a look about such-and-such a subject, by an applicant who knows neither the title nor the author's name, but has a hazy idea that it contains a particular sort of information. This is really as much as most people remember about a book or a paper they have glanced at. Professor Hibbard declares that he gave up note-books ten years ago, and started a card index, or, as it is sometimes called, an "Index Rerum," because it is really a written memorandum of everything that "might come in handy some time." It relates to reading, experience, oral information, engineers, references to catalogues, drawings, newspaper cuttings, suggestions—everything, in short, in which a professional man is interested, and would like to have at his command.

The mechanical portion of a card index comprises, in the first place, the cards. These are made of white linen ledger paper, very tough, of the substance of a very heavy note paper. A thicker card is too inflexible, and too bulky. Thinner ones are not durable enough, and warp. The most convenient size is 3 in. by 5 in. Guide, or leading cards are wanted, at first only for one alphabet. These cards must be much thicker and tougher than the others, because they get more handling. They have tabs sticking up above the edges of the others, when all are stacked on edge. The student may cut and letter them for himself out of cardboard, placing the lettering on the small projecting margin showing ¼ in. or ⅜ in. above the rest. As one's card index gets larger, special guide cards are added with reference to any subject that bulks most in the collection. The cards may for years be kept in a long paste-board envelope box. This is the cheapest form in which a card index can be started; and every student is strongly recommended to make one for himself.

The making of a card index is a growth. Professor Hibbard says that the easiest way to get started is to read the papers with cards at hand, and fountain pen or indelible pencil ready. When an important article is read, forthwith write on the top line of a card what it is all about. This may or may not be the author's title or the title by which the printed matter is published. This selection of a title for what is to be registered is, to Professor Hibbard, the most difficult part of card index making. You are,

he remarks, in peril of indexing an article on compressed air under "C," the adjective, when it would be better to put it under "A," for the noun. It greatly depends, of course, upon what is the attractive or the determining subject, in the estimation of the compiler of the index. In this uncertainty, it is helpful to remember that almost everything possesses at least two parts—its name and its function—and often has other striking characteristics. All these should be cross-indexed, by making out a card for each memorable feature. "A liberal use of cross-indexing is no fault; one's mind does not also work on the same lines, and data might be buried even in a card box. Five years later, one might not be able to recall just the one heading under which he indexed an article, but is sure to remember one out of the several headings of the cross-indexing."

Having written the subject-matter, enter where it is to be found, giving the name of the book or paper, date, and page. It is easy to do this, especially the latter, when the subject is fresh in the mind, but tedious to hunt it up afterwards. Next add in a few words your own description of the book or article, with your opinion of its value or its bearing. Perhaps you can enter upon the card all there is of value in the article. At least enough must be said on the card to give the future searcher after information some discriminating idea of the article, and whether it will pay to re-read in connection with the problem in hand.

If the card relates to unpublished information, such as a manuscript or note book, the reference should be fuller, and the abiding-place of the record shown. The cards should be filed away in proper alphabetical order the same day as made. No accumulation should be permitted, or the whole scheme will be ruined. Later in life, the busy engineer should glance through his technical periodicals as he does his letters, marking anything that strikes him for indexing by a trained assistant. "What may be indexed?" asks Professer Hibbard; and he replies to himself "Everything!" Cuttings may be put into numbered envelopes, these into numbered drawers, and indexed. Leaflets and pamphlets may be disposed of in the same way. Sometimes envelopes, for small cuttings, may best be filed away with the card index. The commercial literature of engineeering, in the shape of manufacturers' catalogues, forms a vast and growing collection of excellent technical matter, which, if some of it requires to be taken with due respect to its partiality, is always fresh and therefore valuable to every engineer. A systematic arrangement of trade catalogues for instant reference is a very important requirement of all who are designers, builders, or purchasers. Numbered, they are put into numbered drawers and indexed, with contents, on the cards. It is convenient also to group catalogues by subjects, if they are torn apart, and the similar portions kept together. The latter is an excellent plan.

In the preparation of professional addresses, and papers for reading or publication, the card index may be made extremely useful. The first stage should be, according to Professor Hibbard, to jot down on temporary index cards facts of interest and data as collected while consulting references upon the subject. The references should always accompany the notes. If there is anything of permanent value in the collection, it can be permanently indexed. These data, as collected, are arranged in sequence; and when the arrangement is complete, the active writing of the address on paper will be an easy business. Correspondence, however extensive, comes perfectly under control when systematized by a card index. It is not advisable to mix up purely office matters, such as drawings, trade catalogues, or business memoranda with the contents of the "Index Rerum." Special card index lists are made for keeping employees' records, for cost price, accounting and stock-keeping, and many other purposes. Indeed there seems to be no end to the developments of the principle in various directions; but doubtless the idea can be overdone, like most others. So far as the question is of keeping the track of technical publications, we can heartily commend the expedient to regular readers of the "JOURNAL," and trust that the rising generation of gas engineers and managers will not lose time in starting their cards. The problem of making generally available for use by working people the portion that is permanently valuable of the enormous and constantly growing mass of professional and technical literature of the day is a serious one, but it behoves everybody interested to solve it for himself as best he can. The plan of referencing herein described is undoubtedly a good one, and should be generally practised.

TRADE IN APRIL, AND COAL AND COKE PRICES.

THE great tidal wave of prosperity that is passing over the United States and is sending her vast and increasing accumulations of capital into new channels [witness the purchase of several lines of British steamers], is having an effect, not material but yet appreciable, upon trade in this country—a stimulus that has in its measure assisted the coalowners in their struggle to maintain prices. The Board of Trade returns of our foreign trade bear evidence of this stimulus. In view of the fact that in 1901 Easter fell in April and this year in March, the most useful way of examining the returns is that of dealing with the aggregate figures for the two months. These show that the exports of iron and steel have increased considerably compared with last year, though still far below the level of 1900, the fourth month of which year may be considered the apex of the trade curve. In the past two months, we have exported 557,360 tons of iron and steel, against 485,524 tons in the same months of 1901, and 691,997 tons in 1900. Of the increase over 1901, shipments to the United States account for rather more than 25,000 tons, and, of course, British manufacturers have been practically free from all competition from America during the past months. Not, however, from all foreign competition, by any means. In the four months just ended, the imports of iron and steel from America fell off from 70,000 tons in 1901 to 6100 tons; while the imports from other countries increased from 50,000 tons last year to 167,000 tons—a net increase of 53,000 tons to set against an increase of 97,000 tons in the exports. On the balance, trade shows improvement during the first four months of the year.

What has, however, done more to assist the coalowners than the slight revival in the iron trade, is the continuance of the high rate of coal exports. During the past two months, the shipments of fuel for sale or use on steamers abroad amounted to 9,422,435 tons, compared with 9,109,927 tons in 1901, and 9,191,017 tons in 1900. As, moreover, coke exports (included in the foregoing figures) have fallen off 35,000 tons in the past two months, the increase in the shipments of coal has been greater than that shown by the total figures for all kinds of fuel. This increase is partly—so far as the comparison with 1900 is concerned, entirely—due to the fact that some steamship owners find it cheaper now to carry from British ports the total coal requirements of the steamers for the out-and-home voyage, instead of coaling at some foreign port, bunker coal being export duty free. But whatever the cause, the effect has undoubtedly been to aid in postponing or modifying the fall of prices, though, but for the shortened output, the increase in shipments would not, of itself, have availed to prevent prices falling to a considerably lower level than they have now reached.

The major question of coal prices for the coming twelve months having now been determined, so far as the London Companies are concerned (and that determination will affect the settlement in the Provinces to a great extent), the minor, though extremely important, question—that of the price that will be realized for coke in the 1902-3 contract year—will soon be calling for consideration. Our friends from across the Atlantic are emphasizing for us daily the value of a combination of interests, of the elimination of cut-throat, senseless competition. Cannot the leaders of the gas industry take the lesson a little to heart so far as coke is concerned, or are petty jealousies always to be accounted of more importance than common welfare? "Splendid isolation" may be magnificent; but is it business?

DANGEROUS CHEMICAL SUBSTANCES IN THE GAS INDUSTRY.

THE meeting of the London Section of the Society of Chemical Industry on the 5th inst. had under discussion a report on "Dangerous Chemical Substances," by Mr. Oscar Guttmann, M.Inst.C.E., F.IC., who had some time ago been asked to serve on a Committee which the Society had appointed to investigate their behaviour. As something was said at the meeting about the report forming a basis on which the Society might make representations to carriers and insurance companies—who at present behave very inconsistently and often harshly towards owners of many such substances—we think it right to refer, before any such action shall be taken, to those portions of the report which concern the gas industry.

The report classifies such dangerous chemical substances as are met with in ordinary trade under seven headings. The first class comprises substances that are easily combustible and liable to spread fire; and many materials that are used or produced in the gas industry are enumerated under it. For instance, there are all combustible volatile liquids, liquid and solid fats and oils, such as paraffin oil, benzine (benzoline), benzol (coal tar), solvent naphtha, pyridine, and carbon bisulphide; also aniline, liquid anthracene, toluene, toluidine, naphthalene, paraffin wax, sulphur, ammonium nitrate, and dusty carbonaceous matter, such as powdered charcoal, sugar, lamp black, flour, and starch. The second class comprises substances liable to spontaneous combustion or decomposition, and includes metallic sulphides. The substances in the third class present risk of fire when in contact with other substances, and include ammonia and naphthalene. Those in the fourth class are liable to explode either by themselves or in contact with others. Among them are all the common explosives and blasting agents, and sulphuretted hydrogen, sulphur dust, calcium phosphide, calcium carbide, acetylene, picric acid, picrates, nitrobenzene, dinitrobenzene, ammonium nitrite, and ammonia. The fifth class comprises substances that emit inflammable or explosive gases, and includes most combustible volatile liquids. The substances in the sixth class emit corrosive gases or are themselves corrosive; and among them are enumerated most well-known acids, including sulphuric and carbolic acids. The seventh class consists of substances that emit poisonous gases or are themselves poisonous. It includes ammonia, carbon bisulphide, nitrobenzene, cyanides, arsenic, and carbolic acid.

Special remarks are made as to a number of substances. For instance, of ammonia it is said that the gas in a concentrated state causes fatal results, and that it is dangerous in contact with oxygen, chlorine, and iodine. Benzene from coal tar is said to

have similar properties to petroleum spirit (benzine). The agitation of textile fabrics in the latter generates electricity, which gives rise to explosions. The addition of soap solution has proved to be a good remedy. Benzine vapours have a stupefying effect. With regard to carbonaceous dust, it is stated that fine dust mixed with air is explosive, while the presence of oxygen carriers and air facilitates explosions. Dust explosions have occurred with coal, lamp black, woody matter, flour, &c. Of naphthalene, it is said that the dust and vapours are explosive. Explosions occur in stills through the choking of the outlet; and textile matter preserved with naphthalene burns like tinder. Sulphur dust is explosive, and can be ignited by sparks or electric discharge. Large quantities of metallic sulphides in the open may ignite. Iron sulphide on iron pipes removed from the ground may become incandescent through absorption of the oxygen.

Truly these brief notes from Mr. Guttmann's paper give a sufficiently alarming notion of the perils with which all who are connected with gas-works are surrounded. But we may find consolation in the fact that neither coal gas nor coal (except for a casual reference to coal-dust explosions) occurs in the list of dangerous substances. We believe that many shipowners would prefer a cargo of pyrites, which appears in the list, to one of newly-won coal of certain descriptions; but apparently their judgment would be at fault. Again, acetylene is certainly somewhat more liable to give rise to explosions than is coal gas; but not so much so as to justify its inclusion in the list, in which no mention is made of coal gas, oil gas, &c. The list indeed reveals many such anomalies; but with most of them readers of the "JOURNAL" will have no immediate concern. But a protest must be entered against the system of classification, which puts calcium carbide and potassium chlorate alongside nitro-glycerine, and paraffin wax and sulphur in the same category as carbon bisulphide and phosphorus. If this list passes into the hands of carriers and insurance brokers as it stands, many comparatively harmless substances will be subjected to needless restrictions, owing to their association in the list with others which are notoriously dangerous; and trade in them will be hampered without adequate reason. Some subsidiary or different method of classification must be adopted for practical purposes. The list may be good from the academical standpoint; but even if it had been presented to the Royal Society, it would not have escaped the trenchant criticism which Dr. Dupré extended to it. As an alarmist report, it would doubtless have been welcome to space in the columns of the "Lancet;" but something of more practical value is expected in the "Journal of the Society of Chemical Industry," in which the list will doubtless appear in due course.

ELECTRIC LIGHTING MEMORANDA.

The Quest of the Day-load—The Traction and Lighting Combination—Who Invented It?—A Chapter in New York History.

THE desideratum of a paying "day-load" for electric lighting generating stations remains as unattainable as it appeared to be some years ago, before municipalities owning tramways learnt to appropriate the brilliant idea of making the provision of electric traction cover up the disappointing lighting commitment. In a few years' time, there will probably be the usual squabble over the question of priority in respect of this great invention—great, that is to say, as a scheme for making Peter pay for Paul. It will be noticed that we have edited the ancient expression, and removed from it the objectionable term characterizing the transaction in its traditional shape. Municipalities do not "rob;" they merely adjust the receipts and expenditures of different departments, so that the net result shall not worry the ratepayers overmuch. But in regard to this notable fashion of making believe there is a real economy in combining electric lighting with electric tramway working, the earliest example of it we have been able to find in the records of the past is American. It therefore appears to be one of those grand American inventions which, like the "French measurement" of electric light, and the system of "trusts," from time to time arise to convince the universe that the locality of origin of wise men has been changed from the East to the West.

The particular invention was started, as it is continued, with an ulterior object. The great Mr. William C. Whitney, so the record runs, found himself with a "white elephant" in the shape of the Metropolitan Street Railway Company, of New York, which, upon electricizing its traction, had failed to obtain legal authority to sell electricity "off," although it had providently made suitable conduits for lighting connections all through the Edison and Westinghouse districts. Thereupon another Company was formed, with the comprehensive title of the New York Gas and Electric Light, Heat, and Power Company—shortly called the "Power Company"—by the same interest, in order to get round this disability. The first act of the Power Company was to acquire the conduits in question, which, however, did not help them much, because there was a legal bar to the monopolistic use of these conveniences. Consequently, there was nothing for it but to approach the Edison Company with an offer to purchase. While these negotiations were in progress, mysterious intelligence began to percolate through the New York newspapers concerning the splendid advantage that would accrue to the users of electric light in the city by the combination of the lighting with the electric tramway service—then a novelty. It was hinted that the Edison Company were obstructing "progress" by continuing to do business in their old-fashioned way. Some swelling notices appeared of the strength of the interests which lay behind Mr. Whitney and his Power Company; and it is stated, without beating about the bush, that the "New York Journal" published about this critical period "a diagram, absolutely without foundation in fact, representing the maximum requirement of electric current for railway purposes as between 7 a.m. and 8 p.m., and for the lighting companies as from 8 p.m. to 7 a.m., in proof of the economy of employing the same electric plant for traction and for lighting. The actual facts were that the maximum came closely together, with little, if any, possible saving by combination, about 6 o'clock on a winter day, when the street cars were carrying the home-goers, and when office lighting and industrial motors downtown overlapped residence lighting uptown. It was announced, as from an official representative of Mr. Whitney, that a reduction of 30 per cent. to consumers might be expected from the economy thus indicated." We quote from an article in a leading American magazine which has circulated the statement, so far as we know uncontradicted, since last October.

After this, it is difficult to withhold from the brows of Mr. Whitney, or some unnamed colleague of his in these transactions, the laurel of this great and notable invention of the combined traction and lighting load in electricity supply. The date is sometime in 1898. It answered. The effect of these and other attacks upon the Edison Company was to convince the custodians of the undertaking that they had better come to terms with the enemy, lest a worse fate befell them. The Edison Company held an apparently strong position, were not over-capitalized, paid only 6 per cent., and applied their surplus profits to the improvement of the plant and the extinction of formation expenses. So glaring an exception to the usual practices by which the electrization of America, which English people are so often called upon to wonder at and admire, has mostly been brought about, was esteemed pernicious by native company administrators of the customary type. This furnished a strong inducement to the pirates; and, besides, the property was not only actually of great value, but showed a large prospective increment. The confidence of the leading Edison proprietors was shaken; and it was a time when no honest man believed in the integrity of the City Government, or trusted the Metropolitan Magistracy. So, against the will of many, the Edison proprietors sold, individually, their stock at 220, paid in 4 per cent. purchase bonds, for which their own property furnished the larger part of the security. Well might Mr. Edison say of this "deal," that it was "paying with the printing press." Still, the operation was pushed to its conclusion. If they had not persistently followed the policy of lowering their charge for current, voluntarily, as the growth of business permitted and they saw their own moderate dividends assured, the Edison Company might have paid themselves 16, 18—almost anything per cent., and could have valued the stock accordingly. As it was, they received just change for a dollar, and no more; and the immediate effect to consumers of bringing the electric lighting into the electric traction undertaking was to stop reductions of the price of the lighting current from that time onward.

TECHNICAL GAS ANALYSIS.*

WHEN two so trustworthy authorities on technical methods of gas analysis as Professors Winkler and Lunge conspire to produce a handbook dealing with them, it needs must be that the host of less experienced and less able technicians who have to make analyses of gases come under a heavy debt of gratitude to them. The first English edition of their handbook, though published so long ago as 1885, has remained to the present day the best general guide to the student of technical gas analysis, and an invaluable aid to the more practised operator. Latterly, however, it has been plain that it did not adequately meet even the students' requirements, owing to the many important advances in methods of gas analysis since its publication; while, moreover, for some time past the edition had been exhausted. Other text-books had, however, appeared in the meantime. But, if we except "Hempel's Gas Analysis," which had a different scope, they were conspicuously inferior to, even though more up-to-date than, the old "Winkler and Lunge." An author competent to write a compact, but comprehensive and reliable, treatise on technical gas analysis in English did not appear to be forthcoming. Publishers of the highest standing would gladly have entertained such a work; but the only offers made them were of matter of pitiably poor quality. That a text-book of the kind indicated has been badly needed during the last few years is a matter of common knowledge to all who have been called upon to make gas analyses by other than the absolutely stereotyped methods. The need is now fairly well met by the new English edition of "Winkler and Lunge," a copy of which is before us.

* "Handbook of Technical Gas Analysis." By Clemens Winkler, Ph.D., Professor of Chemistry at the Freiberg Mining Academy. Second English edition, translated from the Third (greatly enlarged) German edition, with some additions, by George Lunge, Ph.D., Professor of Technical Chemistry at the Federal Polytechnic School, Zurich. London, Gurney and Jackson; 1902.

It is very much larger than the first edition; and is to all intents and purposes a new work. It will be indispensable to everyone engaged in the technical analysis of gases.

This favourable opinion of the book is stated with a full sense of its faults and failings, which are, we think, not a few. Nevertheless, it approaches more nearly to our ideal of a short handbook on technical gas analysis than any other work in the language. Perhaps its most palpable defect is that it remains essentially a German book, though rendered into good enough English, so far as language merely is concerned. It practically ignores English modes of analysis, even though they may be recognized as standard methods throughout the country; and instead it describes unfamiliar, and often more cumbersome, methods devised by some German chemist. For instance, Drehschmidt's and Fischer's types of apparatus for estimating the sulphur compounds in illuminating gas are referred to; but there is no mention of the Referees' apparatus, of which the others are but unimportant variants. Moreover, results of estimations of sulphur, ammonia, and other impurities in gas are, if the directions given are followed, to be worked out in "grammes per cubic metre," though in one place the translator has been thoughtful enough to give in a footnote, the factor for converting the result so obtained into "grains per cubic foot." But the gas-works' analyst should not be put to the trouble of making the conversion, even supposing that be could obtain, without going abroad for it, an experimental meter recording in metric quantities instead of in cubic feet.

The use of the cubic foot as the unit of measurement of volumes of gas is absolutely universal in this country; and gas-works' laboratories are always provided with weights on the grain system (and often on no other). Hence it is absurd to describe for English readers analytical operations on illuminating gas involving the use of meters, &c., on the metric system. It is almost needless to add, that just as the sulphur test is given only in foreign form, so the Referees' ammonia test is not referred to; but a variant is given, which may be convenient enough for many uses, but, as it stands, requires a gas-meter recording in litres. An example given is followed by the statement (unqualified in any way) that "Such small amounts (of ammonia) are not usually expressed in per cent. by volume, but in grammes per 100 litres of gas," which is, of course, absurd so far as English-speaking peoples are concerned. The translator should have seen to it that the book was not merely translated, but Anglicized. So far as gas-works laboratories are concerned, its utility is greatly diminished by this want of consideration for our (possibly) insular customs.

We feel this defect of the book the more keenly because Professor Lunge, at least, must have gained a knowledge, during years of work here, of its seriousness from the English works manager's standpoint. But there is also displayed in many places a want of knowledge of the scientific work done in this country, which alone would justify our statement that the book, though in the English language, is essentially German. For instance, on page 26, it is said: "An apparatus for the expeditious reduction of the volumes of gases to the normal state without the necessity of observing the thermometer and barometer was first proposed by U. Kreusler (Ber. der deutsch chem. Ges, 1884, XVII. p. 29) . . ." We have not verified the reference; but it is very improbable that such priority can be rightly claimed for Kreusler, seeing that Mr. Vernon Harcourt's "Aerorthometer" was exhibited to the Gas Institute in 1883, and was doubtless first made a year or two earlier. Apart from the question of priority, the "Aerorthometer" is a more compact and convenient instrument than the one described in this book for achieving the same purpose; but it is nowhere even referred to. Another instance of ignorance or disregard of English apparatus occurs in connection with the description given of experimental gas-meters. We are told: "It is desirable to possess a gas-meter which is automatically stopped after a certain quantity of gas has passed through. Tieftrunk (Verh. d. Ver. z. Betörd d. Gewerbfl,, 1876, XXXIX., 5th appendix) has described such an *automatically stopped gas-meter*, where, after the passage of 100 litres of gas, the index uncouples a lever, and thus shuts the tap." And that is all. The reader is left uninformed that such meters with an automatic cut-off are stock articles with English makers of testing-apparatus, and that they have been in use in London for official gas-testing purposes since 1872, if not earlier. Of course, it will be understood, from what we have already said, that the descriptions throughout refer to gas-meters with dials graduated in litres.

Such obvious faults might readily have been rectified by the translator.* There are also some inaccuracies. For instance, it is said, without any limitation, that "Coquillion showed that a mixture of methane and air in contact with red-hot platinum or palladium burns perfectly without explosion." Yet it is common knowledge that red-hot platinum does explode a mixture of methane and air, unless the proportion of methane in the mixture is very low, or the conditions are otherwise unfavourable to explosion. But, on the whole, the book is very trustworthy, especially in its descriptions of actual analytical operations. We are disposed to think that too sharp a line of demarcation has been drawn between so-called "technical" methods and so-called "exact" methods of gas analysis. The two classes have recently merged so inseparably into one another, that it is now possible to make an "exact" analysis of a sample of coal gas (for instance) as rapidly as a complete analysis of such gas could be made by any of the "technical" methods described in the book before us. With the old forms of "exact" gas analysis apparatus, modelled on the Frankland and Ward type, an analysis of coal gas often occupied five hours; and the task of calculating the results was no light one. But equally precise results are now attainable, thanks to improved apparatus, in less than two hours; and the calculations required are quite simple. There is no need in such cases to sacrifice the water-jacket, which Professor Lunge regards as hampering the manipulations. Of course, the water-jacket may be discarded for technical purposes in portable or special apparatus.

In conclusion, we repeat that a book such as that before us was badly wanted by English technical chemists, and that Professors Winkler and Lunge have to a large degree met the want. But they have not given us the ideal English short handbook on technical gas analysis. No mere translation of a German work is ever likely to attain this ideal. The ideal text-book on the subject must almost inevitably come from a really competent English works' chemist, thoroughly familiar with what has been written in Germany and done here. The English chemists who will be able to gain most advantage from the present work will be those whose training has been such that they could use the German edition without difficulty. On the other hand, if the work had been properly Anglicized, others would have been equally well served by it. A translator, especially when dealing with a technical work, should endeavour not merely to give the equivalents of the author's words, but further to transfer all incidentals of the author's environment to those of his reader, so that the latter may be spared the trouble of thinking out for himself what some unfamiliar foreign convention implies to him. The labour of transposition of terms, whether weights, measures, or what not, into those commonly understood by the people who will use the trans lation, should be borne once for all by the translator, and no thrown afresh on each and every reader. Professor Lunge, we are sorry to say, has left this labour to his readers.

THE GAS AND WATER STOCK MARKET.

(For Stock and Share List, see p. 1304.)

Business last week in pretty well all departments of the Stock Exchange was quiet and devoid of interest. Beyond some cautious buying of Consols and the pick of the gilt-edged division, operators were decidedly inactive. Everything seems to be awaiting the issue of the Peace Conference; and if this should be auspicious, then the reopening after the Whitsuntide holidays may witness a revival such as is almost out of memory. While thus marking time, prices have not varied much, except where special circumstances have operated to affect them. In the Money Market, there was a very fair demand; but the supply was fully adequate, and the tendency at the close was rather easier. In the Gas Market, business on the whole was quieter; and towards the close transactions became fewer and fewer. There were more changes than usual in quotations, and they were quite irregular and difficult to follow. The same issues would go down one day and up the next; and what the next move might be there was no telling, so capricious were movements. On the whole, the downs more than counterbalanced the ups. In Gaslight issues, the ordinary was moderately active, and was one of those to fluctuate. On Monday it was marked at 93; on Wednesday, it fell a point, and changed hands at 91¾; then on Friday it was up again and back to 93, at which figure it closed. The secured issues were moderately active; but prices were poor, and were inclined to drop. The actual fall, however, was confined to half-a-point off the preference. South Metropolitan was another of the oscillating stocks, falling one day and rising the next. But on the whole, it was weaker; and on Friday it changed hands at 119—a lower point than has been touched for some time. Nothing at all was marked in Commercials. Very little business was done in the Suburban and Provincial group; but there were several changes upward and downward. In the London market, Brighton original and Tottenham "B" advanced; while Brentford old receded. On their local Exchanges, there was a set-back in Liverpool and Newcastle. The Continental Companies were very inactive. Further hostility to Union was evinced, the ordinary changing hands several times at 145; and even the preference dropped a couple of points. Imperial also had a slight fall. Among the remoter undertakings, Ottoman had a rise. In the Water Companies, the continued inanition ruling of late was followed by weakness, and Chelsea, Grand Junction, and West Middlesex were each lower.

The daily operations were: Business in Gas was only moderate on Monday, and prices were poor. Brentford old fell 2, and Union 1. Tuesday was, if anything, quieter; and again the tendency was flat. Both Unions fell 2, and Imperial 1. In Water, there was a fall of 5 in Chelsea, 2 in Grand Junction, and 5 in West Middlesex. Wednesday was more active; but business was almost confined to Gaslight and South Metropolitan issues. The ordinary stock of each fell 1. Thursday's transactions were on much the same lines; but Brighton original and Tottenham "B" rose 2 each, and Ottoman ¼. South Metropolitan, however, fell 1, and Gaslight preference ½. On Friday, prices were better; and both Gaslight ordinary and South Metropolitan rose 1. Saturday was quiet and unchanged.

PERSONAL.

Mr. William Methven has been appointed Manager of the Beccles Gas-Works, in place of the late Mr. C. F. Parker. It is Mr. Methven's intention to still carry on the Bungay Gas-Works as at present.

Mr. George Helps, the Manager of the Nuneaton Gas Company, recently had a narrow escape from serious injury while out driving with Mr. Charles Blakeway, the Clerk to the Nuneaton Guardians and Rural District Council. The horse shied, and dragged the trap up an embankment. Mr. Blakeway was hurled out, and unfortunately sustained concussion of the brain and injuries to the right eye and face. Mr. Helps was thrown under the trap; but fortunately the horse immediately came to a dead stop, and Mr. Helps escaped uninjured.

OBITUARY.

We regret to record the recent death of Mr. J. G. O'Farrell, who was for about twelve years Manager of the Newbury Gas-Works. On relinquishing this position, he went to Porto Rico, where he remained for five years, and thence to Ciudad Real, in Spain. He joined the Gas Institute in 1880, while he was at Newbury, but remained a member only two or three years. Of late he had resided at Bowes Park.

The recent death is announced, at a very advanced age, of Mr. John Glover, inventor of the well-known tower which bears his name. From the humble position of a plumber's apprentice, he became Manager of large chemical works at Washington, where he worked out the idea of his acid-saving tower, for which, though it is stated to have enriched the country to the extent of £300,000 a year, he received little pecuniary reward, not having patented his invention. Its merits were acknowledged by all competent authorities; and at the annual meeting of the Society of Chemical Industry in 1896, the President (Mr. Tyrer) presented Mr. Glover with a gold medal, "for conspicuous services to applied science."

Welsbach Lighting for Outdoor Illumination.—We learn from the General Manager of the Welsbach Company (Mr. Kenneth H. Buchanan) that the special suitability of their system for railway station and general outdoor lighting is being more widely appreciated, as is shown by orders which have recently been received. The six self-intensifying burners at the London Bridge Terminus of the Brighton and South Coast Railway have given such satisfaction that it has been decided to light all the stations to Croydon with Welsbach-Kern burners, which are now in use on all the stations of the District Railway from Whitechapel to Putney Bridge and Hounslow. The Metropolitan Railway have given instructions for lighting Gower Street Station with self-intensifying Welsbach-Kern burners; and the system is being extended to other stations on this line. The Whitechapel and Bow Railway have placed with the Company an order for 112 Welsbach self-intensifying lanterns and 30 Kern burners.

Recent Blast-Furnace Practice.—At the meeting of the Society of Engineers on Monday last week—the President (Mr. Percy Griffith) in the chair—a paper on the above subject was read by Mr. Brierley D. Healey. He dealt *seriatim* with the plant and machinery of an iron-works, from the blast-furnace to the pig-bed and slag-removal appliances, and drew comparisons between the old and the new methods of working; showing what great advances have been made during the past forty years in blast-furnace practice. Having described the latest improvements in the plant, he made some practical references to the need for utilizing the bye-products, and particularly to the use of the gases for driving engines for blowing purposes and for electric lighting, and also power for the minor machines. He mentioned a case where the gases would not burn in the steam-boilers without the help of solid fuel, but were used in the gas-blowing engines at the same works without any difficulty whatever. He mentioned that designs were being prepared for the rebuilding of one works in Staffordshire, where a special feature will be the absence of steam-boilers—the power obtainable from the furnace being fully utilized.

A Well-Preserved Water-Main.—In connection with the works for the extension of the Paris Metropolitan Railway, it was necessary to remove the principal main conveying into Paris the waters of the Vanne. It was a cast-iron pipe 31½ inches in diameter, laid in lengths of 13 feet. The joints were of the spigot and socket type, made good with lead. According to some particulars given in "Engineering," the removal was accomplished with the greatest facility. It was unnecessary to melt out the lead; and the breakages on a length of nearly a mile did not exceed 2 per cent. It was further found that the pipe, which was laid in 1874, and has been in constant use since, was in a most excellent state of preservation. Internally it was covered with a deposit of lime ¼ inch thick, which was easily removed by the hammer. Beneath this the tar coating was found in many cases almost intact, and the shop numbers in white lead could be read as easily as though they dated from yesterday. The iron itself was perfectly clean and free from rust. Externally the condition of the pipe was nearly as good. The tar coating still covered most of the outer surface; and, where absent, it was replaced by only a thin coating of rust. In fact, after 28 years' service the pipe was practically as good as ever.

NOTES.

The Use of Cooking-Ovens.

A writer in the "Ironmonger" discusses the uses of the ovens of ordinary coal cooking-ranges. He remarks that where there is only one oven, this is usually the old type of Leamington oven, with the direction of the flues first across the top, then down the farther side, then across under the bottom before ascending the back flue. When there are two ovens in a range, there ought to be this difference between them—that in one the flues are disposed as already described, while the other should have the heat first led underneath the bottom, for baking pastry. This is not often done; the ovens of ordinary cooking-ranges being made alike, with the result that they do not give satisfaction for all purposes. Practically, meat does not require bottom heat; whereas this is precisely what pastry and bread-baking does require. Consequently, to cook these goods in a Leamington oven with excess top-heat, is to court failure in nearly every instance, which is one reason why the gas-oven is so much more successful in pleasing the cook who has once learnt that, by putting in or leaving out an iron shelf, it will give top or bottom heat at will—and both at once, in different regions of the oven. A little top heat is needed for pastry; but this is more for browning and colouring than for actual cooking, which is mostly done from the bottom. Few range ovens are properly ventilated; but even a greater drawback is the difficulty of cleaning them with sufficient thoroughness to prevent risk of unpleasant odours when the iron is made thoroughly hot.

The Waste of Fuel in Boiler Furnaces.

Writing to the "Engineer" with reference to Professor Perry's recent appeal for the appointment of a Special Commission to devise a means of more economically using coal for general motive power, Mr. John B. C. Kershaw remarks that, pending such a reference, it behoves engineers to make the best possible use of the means at their command. This is not done. Very few steam-boilers are worked by their users so as to yield the highest possible efficiency. Often at least one-half of the fuel burned could do the same amount of work, if properly managed. The most direct way of ascertaining how the furnaces are being worked is to sample the chimney gases for carbonic acid. With reasonably careful firing and the proper draught, an average of 14 per cent. of carbonic acid should be present in the chimney gases. The ordinary proportion is far below this figure, some experienced observers putting it as low as 8 per cent. This low percentage is entirely due to excessive draught; and it is a striking commentary on the science of smoke abatement that Mr. Kershaw attributes the frequency of excessive draught in modern boiler firing to the deliberate choice of the engineers in charge of this expedient for escaping smoke persecutions. Electric light engineers—especially those in charge of town stations—are hardened sinners in this respect. So long as they can get air enough through the furnace to burn the fire brightly, with as little smoke as may be, they are reckless of the consequences that this entails an extra consumption of fuel. Assuming the proportion of carbonic acid in the chimney gases generated under these conditions to average 8 per cent., this means an excess of fuel consumption of about 10 per cent., as compared with the consumption at the level of efficiency represented by 14 per cent. of carbonic acid. This disclosure is unfortunate for the smoke prevention movement.

French Views of Armoured Concrete.

The development of reinforced concrete construction is much more a Continental than a British engineering speciality. Accordingly, it is not surprising that the most important book on the subject that has hitherto been published is the production of a French engineer, M. Paul Christopher, of the Ponts et Chaussées. This author attributes the invention of armoured concrete construction to M. Monier, who carried out some experimental applications of it thirty years ago. In the Monier system, the metallic framework consists of a number of parallel rods intersecting one another at right angles, and forming a rough lattice work. It is difficult to perceive why this arrangement should not be as effectual as any other of the hundred-and-one varieties of the same kind of construction more or less in vogue. While the practical advantages of this construction are obvious enough, the theoretical consideration of the subject, to which French engineers are so addicted, is extremely complicated, tedious, and inconclusive. Calculations of the strength of reinforced concrete depend upon the validity of certain deduced empirical formulæ, which are so intermingled with hypotheses and assumptions of the vaguest authority, that the results cannot be regarded as reliable. This is not for want of abundant experiments intended to elucidate the mutual relationship of the concrete and the metal, but by reason of the inconfutibility of the conditions of the different experiments. Consequently, there is ground for the criticism of armoured concrete that no one knows how strong (or weak) any example really is, even within the wide range of possibility lying within the most generous factor of safety. This appears to be the chief fault of the system of construction. No two specimens of concrete need be exactly alike, however carefully they are prepared. Nobody ever knows how a given piece of concrete will break, whether by crumbling or by a sharp fracture. At

times it will crack a long time before giving way; at other times it will give way all at once. It is not to be wondered at that engineers are not over-trustful of the material.

A New Iron Paint.

It is reported in the American "Electrical World" that Dr. Alexander S. Ramage, of Cleveland (Ohio), has described a method of preparing a new iron pigment, having an old formula and new properties. If this is the case, it is hard on chemistry. The new preparation is described as a hydrated basic ferric oxide. It is one of the first commercial fruits of those physico-chemical theories which have been developed by the study of dilute electrolytes. The source of the new product is the waste ferrous liquor derived from iron pickling, which is generally ferrous sulphate or chloride, with some free acid. This is neutralized and afterwards oxidized by the joint action of air and steam. As the oxidation proceeds, an alkali—as sodium carbonate in solution—is added in quantity sufficient to maintain substantial neutrality; and simultaneously therewith a large quantity of water appears to be the true precipitating agent. The effect is that known as hydrolysis, or the decomposition by water of a salt composed of a base and an acid between which there is a great disparity of strength—in the present case, a compound of a weak base with a strong acid. By the oxidation of ferrous sulphate, basic ferric sulphate is formed; and this salt, in the presence of the large volume of water, is hydrolyzed, yielding sulphuric acid and basic ferric hydrate—the pigment in question. A reaction of this kind would, of course, soon reach an equilibrium, and the yield of pigment would be but small; but here the gradual addition of the alkali to combine with the acid as it is liberated comes in to ensure the continuance of the reaction to complete the precipitation of the iron. The pigment is of a light yellow colour, but is readily changed by heat into the usual iron oxide reds. Its absorptive capacity for oil greatly exceeds that of the standard pigments, being $2\frac{1}{2}$ times that of standard French ochre, and $7\frac{1}{2}$ times that of white lead. Its covering power, as compared with these pigments, is almost proportionately high.

The Late Mr. Pope.—To perpetuate the memory of the late Mr. Samuel Pope, K.C., a movement has been started to present to the Middle Temple, of which he was a Bencher, a cup bearing his name. A Committee in furtherance of this project has been formed, consisting of Mr. Littler, K.C., C.B., Mr. Pember, K.C., Sir Theodore Martin, Sir John Wolfe-Barry, Mr. Honoratus Lloyd, Mr. Ashby Pritt, and Mr. Charles Hawksley.

Water Companies and Rebates.—Many of our readers were doubtless reminded, by the reply given by the President of the Local Government Board to Mr. Weir, a few days ago, that the West Middlesex Water Company have for some years allowed their consumers a rebate of 10 per cent. on their charges. This, unfortunately, they have lately been compelled, owing to the payment they have to make to the Chamberlain of London's fund, increased rates, and higher prices of labour and material, to reduce to 5 per cent. They nevertheless occupy in this respect, we believe, a unique position among the London Water Companies; and we can only call to mind one other undertaking which takes rank with them, and that is the one at Luton. Since their incorporation in 1865, the Company have paid full maximum dividends and all arrears; and prior to the past half year they had accumulated reserves to the full amount authorized by Act of Parliament. The Directors have consequently now been able to allow a rebate of $7\frac{1}{2}$ per cent. upon the water-rate. These two instances of participation by consumers in the profits arising from the successful management of water undertakings in the hands of companies cannot, we are sure, stand alone; and we shall therefore be pleased to hear of other cases within the knowledge of any of our readers in which a rebate has been, or is now being, given. They will be well worth placing on record.

The London County Council Buy the Old Site of the Pimlico Gas-Works.—It is a curious circumstance that it should happen that the London County Council, who, in two or three sessions of Parliament, so strongly and successfully opposed the granting of monetary powers to the Gaslight and Coke Company, should be the first to place at their command what, even for the Company, can be described as a fairly considerable sum. It may be remembered that the Company, having no further use for the site of their old Pimlico works, offered it for sale by auction; but they failed to get a bidder at the reserved price. A short time after it was rumoured that the site had been privately disposed of; but the name of the purchaser was not divulged. It now transpires that it was the London County Council, and that they have given £80,000 for the land. This is kind of the Council under all the circumstances; but it seems a bit unkind that it should be the lot of this old gas-works site to be utilized for electricity generation. It is, however, a little mollifying to know that the electricity is only required for tramway working. The County Council Highways Committee have asked that power may be sought in the present session of Parliament to enable the utilization of the site for this purpose. The Parliamentary Committee are informed that it may be possible to obtain the sanction of Parliament to the proposal this session; and, as a matter of urgency, they have given instructions for the necessary steps to be taken. At the meeting of the Council to-day, the Parliamentary Committee will seek confirmation of their action and full instructions.

TECHNICAL RECORD.

MANCHESTER DISTRICT INSTITUTION OF GAS ENGINEERS.

At Mansfield—away in the far south-east corner of their extensive district—a large number of the members of the Manchester District Institution of Gas Engineers had assembled before noon last Saturday. The distance was not a deterrent to attendance, for many of the members even came from the northerly part of the district; and the attractions held out to them by the enterprising town were several. Foremost was the popularity of the President (Mr. Arthur Graham), whose innate *bonhomie* has been the means of fastening on to him the friendship of professional brethren from far and near; and, consequently, there was a very general desire to do him honour in his own town. Secondly, the new and energetic Hon. Secretary (Mr. R. G. Shadbolt) had taken steps to acquaint the members early of the plans of the Corporation Gas Committee to make the day an enjoyable one for their visitors; and, through their exceeding kindness and the high standard of their appreciation of the duties of hosts, the time between the half hour after noon and six o'clock in the evening, was spent in constant change—in festivity and visits, the latter being varied by inspections of the gas-works and water-works, the exhilarating pleasure of driving through beautiful open country, with attention drawn to notable features, and last, but by no means least, was the utmost good fellowship which existed between the hosts and their guests, and which placed one and all in their intercourse upon the level of old-standing friends. His Worship the Mayor (Mr. T. Taylor), the Chairman of the Gas Committee (Alderman Blake), the Chairman of the Water Committee (Alderman Barringer), and other members of the Corporation, by their energy and constant attendance throughout the day, relieved from the shoulders of the President a considerable part of the burden of entertaining such a large muster.

Before proceeding to recount the day's doings, a little information may be interpolated here as to Mansfield itself. To each of the visitors was presented, "With the President's Compliments," a tastefully prepared memento of their visit, in the shape of a beautifully illustrated pamphlet giving, in outline, an account of the industrial occupations of the town and also views and particulars of the stately homes situated in the neighbouring Dukeries, with the charms of which most of our readers have no doubt become acquainted at one time or the other. But in regard to the industries of Mansfield, Mr. Graham imparts some information which shows that the town is more closely identified with the gas industry than is, we think, very generally known. The President writes:

> Mansfield is one of the most enterprising towns in England, and is noted for its many different industries. Years ago, it was noted for silk manufacture; but this trade has now become extinct. Its stone is one of the finest known stones for building purposes. Mansfield red sand goes all over the world, and, renowned for its fine texture and suitability for casting purposes, is highly appreciated and much sought after. It is owing to the fine quality of this sand, and its proximity to the blast-furnaces of the Stanton, Staveley, and Clay Cross Iron Companies (which are well known for the splendid production of pipes of all sizes), that Mansfield produces so many castings for the London market. No doubt members of the gas profession will be surprised to learn that the Kirkham, Hulett, and Chandler washer-scrubbers, Marshall's condensers, castings for Pulsometer pumps, Beck's water-meters, Sugg's, Hulett's, and Pontifex's lamp-pillars, and Cleland's patent condensers and scrubbers are cast at the Mansfield foundries.

A Luncheon and a Welcome.

With this prelude, we will follow the course of the events of the day. The meeting place was the famous old hostelry known as the Swan Hotel; and at 12.30 prompt, the members and their friends went to the long, old-fashioned dining-room to indulge in the opening entertainment provided by the Gas Committee—that was, the luncheon, which was of a bountiful character and served in the good old English style which hungry travellers can appreciate. At the head of the table sat the hosts. The Mayor was in the chair (wearing the emblem of his office), and to his right and left sat Alderman Blake, Alderman Barringer, the President, and other representatives of the corporate body. The last course having been served, the Mayor allowed no waste time; but was soon on his feet giving the usual loyal toast.

The old walls had hardly ceased echoing the strains of the National Anthem, when he was up again, proposing "The Manchester District Institution of Gas Engineers." On his own part and for the Corporation, he first gave the members a very hearty welcome; and then he went on to recognize the worth among professional men of visits of the present kind. His following words indicated that the Corporation of Mansfield have a keen and enlightened perception of the relations which should subsist between their officials and themselves. They regard their professional officials as their trained advisers on the matters pertaining to their own special departments; and, as such, they place considerable trust in them. This is not (it may be parenthetically remarked) the case throughout the country; and the more the pity it is so. His Worship's concluding remarks were: "I

have known your worthy President a great number of years; and I am sure I may tell you the Corporation are proud of him. I was here when he was elected as our Gas and Water Manager. I do not think I have ever told him this before; but I may tell him now that he got the appointment very easily. We were proud to get such a gas man among us; and, as you will see when you visit them, our gas-works have improved greatly since his appointment." The toast was very heartily honoured by the hosts and friends. The President, in responding, cordially thanked the Mayor, the Corporation, and his Committees, and assured them of the gratitude of the members. He informed them as to the objects of the Institution; and then, referring to the personal remarks the Mayor had made, he stated how great was his satisfaction to think that his services were appreciated so much as to justify the Committee in extending such great kindness to him, as the President of the Institution, as they were doing that day. His concluding observations were addressed to the members. He mentioned that the voting papers for the Council of the Gas Institute would shortly be distributed; and he appealed to them to support the candidates of the Northern and Eastern Counties, and their own district—viz., Mr. Dunn, Mr. Troughton, Mr. Ogden, and Mr. Townsend. He said it was important the three Associations in the districts should be represented on the Council of the Institute.

Following this, the Vice-President (Mr. S. R. Ogden) submitted the only other toast, "The Mayor and Corporation of Mansfield." The ancient record of the town, and its enterprise in the past and present, afforded him ample material on which to dwell; and in his remarks on the progressive energy of the town, he introduced the observation that he was sure the Chairman of the Gas Committee must feel that he had one of the prettiest little gas-works to be found in the length and breadth of the country, and works which the members of the Institution would not only appreciate, but would ever bear in remembrance. Alderman Blake made an interesting response. Having expressed his confidence that Mr. Graham would do both the Institution and himself credit as President, he said that the Corporation realized that public bodies must be governed to a large extent by officials; and, in their own case, their gas-works were remarkably governed by an official. (Laughter.) It was, in his opinion, a wise policy to work amicably with their officials; and here he said that, though their Engineer liked to have his own way, the Committee fully knew that it was all intended for the benefit of the concern. If all corporations had good officials, and worked well with them, then municipal trading would not be cried down in the way it had been. Alderman Barringer, on behalf of the Water Committee, also responded.

A Brief Business Meeting—Balloting for Officers, &c., and Extending the Scope of the Institution.

The visitors having left the room, the members devoted a few minutes to the consideration of business matters. The minutes of the last meeting were read by the Hon. Secretary, and were unanimously adopted. A list of the apologists for non-attendance was read; and then the President made an announcement on two subjects which the Committee have under consideration as the outcome of the proceedings at the last meeting. First, upon the subject of the balloting for officers, &c., he said the Committee had spent a considerable time over this question, and had discussed it in all its bearings. Eventually they came to the unanimous conclusion that the election of officers and members would be best carried out by the ballot system. Necessarily, there would be a lot of new rules to draw up. This was therefore a question of too great importance to rush through speedily; and so the Committee asked for a little more time to further consider the matter. However, he hoped that at the next meeting they would be able to lay before the members in proper form all the points and matters connected with the subject. Then as to the Committee's report on the extension of the working scope of the Institution, this was another very serious question for consideration; and when he said that it meant launching out into a very broad and new sphere for an Institution of this kind, it would be agreed that it required very careful consideration not only by the Committee, but by the whole of the members, who would have to go very minutely into all the details. At the same time, he might say that his own view was that it was the right thing to do, especially in the Manchester district, where there were so many gas-works closely connected together. If, for example, they would all be true to each other, and establish tar distilling and sulphate works, there was no doubt they could make a very good thing out of it. However, in view of the importance of the subject, the Committee also asked for more time for its discussion, The next item on the programme—an illustrated sketch of "Mansfield and its Surroundings" by himself—they would take as read.

Mr. Chester's Illness.

Proceeding, the President said: There is one other matter I am sorry to have to lay before you. No doubt you have all heard of the illness of one of our members, and a near neighbour of my own—Mr. Chester. He is in a very serious state—so serious, in fact, that I am afraid he will never get better. The least we can do as an Institution is to pass a vote of sympathy with Mrs. Chester and the children. The same thing was done at the meeting of the Council of the Gas Institute last week. I therefore propose that a letter of sympathy be written to Mrs. Chester. I feel sure that this will be very consoling to her under the sad circumstances.

The members silently acquiesced in the proposition.

The Gas-Works Visited.

The foregoing being all the business to claim the attention of the members, they at once proceeded to visit the gas-works. Before specially mentioning one or two points of interest about the plant, we may take from the President's pamphlet the following statement regarding the undertaking:—

The works were built in 1825 by a small Company entitled The Manfield Gaslight Company, and remained in their possession until 1878, when the undertaking was sold for £37,500 to the Mansfield Commissioners. The writer came to Mansfield on Aug. 1, 1893, the same day the great coal strike commenced, and found only three weeks' stock of coal on hand This strike cost the gas undertaking £700. The make of gas at that time was 61,974,000 cubic feet, with a capital of £57,500; and the prices of gas were 3s. 2d., 3s. 6d., and 3s. 9d., with no meter-rents. The following extract from the minutes of the Committee of Oct. 4, 1893, shows what a very unsatisfactory state of affairs existed: "The period under review has been one of unusual difficulty and anxiety to your Committee, owing to the fact that the accounts for the year ending March 25, 1891, had shown a deficiency in the revenue account of £597; and notwithstanding an advance in the price of gas made in September, 1891, the accounts for the year ending March 25, 1892, showed a deficiency of £1060." At this time, in the depth of winter, 110 mouthpieces were at work making only 8500 feet per ton of coal carbonized, and 3000 feet per mouthpiece per day. During the past year the make of gas was 103,228,000 cubic feet, showing an increase of 66 per cent. in nine years—a highly satisfactory result. The capital account has been increased from £57,500 to something over £64,000. The great increase of make, with so small an increase of capital, is owing to nearly all the alterations and extensions being paid for out of revenue. The whole of the authorized capital (£60,000) having been expended, an Act of Parliament was obtained last year, and power was granted to raise £30,000 additional capital.

During the past nine years, the majority of the mains, services, and meters have been renewed. The retort-house has been re-modelled, having 96 retorts for 103 million make, against 112 for 61 million make. But this part of the works, as well as the gasholders, is getting too small; and the question of erecting further gas-making and storage plant is at the present time under consideration by the Committee. Two years ago a new purifying plant was put down by Messrs. C. and W. Walker, consisting of four 25-feet square boxes with Weck's centre-valve, which work very satisfactorily; and last year, the old tower scrubber was extended, and two new tower scrubbers put up by the firm of Messrs. Sansom Bros. and Co., Mansfield. These have also turned out very satisfactorily. You will be surprised with the amount of gas made on such a small area of ground. The system of handling coal at the works is very antiquated, as you will observe; but this matter is under consideration by the Committee at the present time, who have been anxiously waiting for a railway siding. But as terms cannot be arrived at, I am recommending the construction of an elevating and conveying plant.

About four years ago slot meters were introduced; and at the present time upwards of 900 are in use, which have considerably helped to increase the consumption.

It is a great satisfaction to the Manager of an undertaking to have a Committee always alive to the best interests of their works; and this fact has in no small measure contributed to the very satisfactory condition of the concern at Mansfield.

[Appended to this little account of the undertaking was a copy of the first balance-sheet, showing dividends paid, of the old Mansfield Gas Company. It covered the period from July 1 to Dec. 31, 1830; and the items are very interesting when compared with the condition of things to-day. The total receipts for the six months were shown to have been £611 17s. 2d.; and we see that coke then only brought in £46 5s. 2d., and tar the magnificent sum of 17s. 4d. The profit tha half year was £253 8s. 7½d. On April 2, 1831, the total capital expenditure was £7707 1s. 9d.]

The members were very interested in the works. It was observed that Mr. Graham believes in rendering his plant as beautiful as a gas-works plant can be made, by a judicious variegation of the colours of the paint used. There was a freshness about the place which told without words that, the heavy work of winter having passed away, the plant had been brightened up for the summer. The retort-house was passed through with interest, as there the members were able to inspect the settings containing the 96 retorts with which the President is able to make over 103 million cubic feet of gas, as compared with the 112 retorts and the 61 million cubic feet of a bygone time. By the way, the fact that 66 per cent. more gas is required now than when Mr. Graham took over the management is a proof of his and the Committee's energy and enterprise. It was observed that at one end of the retort-house the settings are on West's regenerator principle; and at the other end on Drake's regenerator system. A small coke-screening plant attracted attention; and it showed that Mr. Graham cultivates a home consumption for this product. The new purifying plant, which is referred to in the extract from the pamphlet, was perhaps the chief feature of interest. The boxes are on the stage-floor plan; and the house is of very ample proportions, both in area and height. Its floor measurement is 120 ft. by 40 ft.; and the building is fully equipped for facilitating the operations connected with the plant.

Adjoining the gas-works, the building of extensive electrical works is in progress. We do not know what reasons weighed with the Corporation in choosing this site for the works, as their erection here completely hems in the gas-works on the side on

which extensions of the gas plant in the future could, it seems to us, have been most favourably made. However, the buildings are going ahead fast; and the Council are committed to an expenditure on them of £53,000. They are intended to feed an extensive electrical tramway service, as well as for the ordinary purposes of lighting and power.

To the Rainworth Water-Works.

Outside the gas-works was quite an array of vehicles, which were all fully required for the conveyance of the 80 or so gentlemen who formed the party. Their destination was the new water-works of the Corporation at Rainworth. The drive through pleasant country, and the weather being bright and just sufficiently sharp to be exhilarating, was immensely enjoyed.

A break may here be made to again take a paragraph or two from Mr. Graham's account of Mansfield, where he specially deals with the water-works. He says:

In 1870, an Act was obtained by a private Company for supplying Mansfield with water; and this Company continued to own the undertaking until 1889, when it was purchased by the Mansfield Improvement Commissioners—the then governing body of the town—for £29,850. As the supply of water was so unsatisfactory, both for quality and quantity, steps were at once taken to improve it. A well was sunk at Rainworth, which is in the borough, but at a distance of about 3 miles from the Market Place. The construction of the pumping-station, reservoir, and mains, cost upwards of £21,300. The depth of the well is 110 feet; and the contract for sinking and proving the same was £5275. The engines are capable of pumping 72,000 gallons per hour. The storage capacity of the new reservoir is 800,000 gallons, and that of the old one 240,000 gallons. In addition to giving a good supply to the borough, agreements have been entered into and a supply given to Mansfield Woodhouse with a population of over 4000, and Tibshelf with a population of over 7000. A supply will shortly be given to the parish of Pleasley. The undertaking is now a paying concern. Besides providing for sinking fund and interest, a considerable sum is handed over to the relief of the rates of the town.

This account was sufficient to apprise the members that they would find works bearing the marks of good management and engineering; and, on alighting at Rainworth, they were not disappointed. The pumping-station is very pleasantly situated; and everything looked so spick-and-span and orderly from the grounds around the building, to the building itself, the machinery within, and the well (which was electrically lighted) below, that Mr. Graham must have been quite as well pleased to show his colleagues the place as the latter were to have the opportunity of inspecting it. The two high-pressure engines, of 120-horse power, were examined with as great an interest as would have been a new setting of retorts. It was observed that they bore the date 1894, and the name of the firm of Easton, Anderson, and Goolden, Limited, as the makers. A mural tablet showed that the house was constructed in 1895. As already indicated, the building is lighted electrically, as is no doubt best in its lonesome situation, the current being generated by a little plant occupying a small space in one corner of the workshop. This plant many of the gas engineers present regarded as a pretty and useful piece of mechanism, albeit it was the progeny of the rival camp. The pair of boilers in the adjoining house were also examined. Mr. Graham gave the information that the water is supplied to a distance of 14 miles, that it is a very fine water, and has only 6° of hardness. Although pumping has been going on at Rainworth for over five years, the level of the water in the well has not varied 3 inches. We compliment Mansfield.

There was a little deviation in the route on the return journey, in order to give the visitors an opportunity of inspecting the new reservoir a short distance away. This done, they remounted their conveyances, and by 4.50 were again at the Swan Hotel.

A Pleasant Day's Ending.

A substantial tea awaited the party. Afterwards, the members made a hearty acknowledgment of the very handsome and graceful reception that they had received at the hands of the Corporation and the President. A few minutes after six, those who could not stay the week-end had to leave in order to catch their trains to the north; but they found it difficult to tear themselves away from their generous hosts and such a pleasant company. This day alone will suffice to keep green the year of Mr. Graham's presidency in the memory of those who were fortunate enough to be able to reach Mansfield on Saturday.

OHIO GASLIGHT ASSOCIATION.

Annual Meeting at Columbus.

The Eighteenth Annual Meeting of the Association was held on March 19 and 20—the President (Mr. Henry L. Doherty, of New York City) occupied the chair. The report of the Executive Committee, which included a recommendation of 14 new candidates for membership, was adopted; and the report of the Secretary, which gave a total roll-call of 225 active and 13 honorary members, was also adopted.

Inaugural Address.

The President delivered his Inaugural Address, in which he stated that the past year had been characterized by a healthy growth of business. In works having an output of 2 million cubic feet of gas per day or over, it was possible, according to European experience, to save about 3d. per 1000 cubic feet, and also diminish labour troubles, by adopting machine stoking. It had been proved that washing and scrubbing could be effectively done without the aid of mechanical devices. Tower scrubbers were very effective, provided the water was properly distributed; but he doubted if they would excel the new brush scrubber. Water cooling was a great assistance to efficient condensation, as it could easily be obtained at atmospheric temperature or a little lower; and it could be cooled by natural evaporation in hot summer weather. Purification was largely a question of capital invested; and he was confident that the proportional meter would eventually prove a success, and displace the big, cumbersome station meter. The day consumption was now so important that the storage capacity was greatly relieved. At one works, the holder contents did not vary greatly throughout the twenty-four hours; and at another, the annual output was 288 times the maximum daily output. Water gas was largely dependent on the oil market. A great saving in fuel could be effected by increasing the blast pressure—giving a greater velocity through the mass of fuel, and a much larger production of carbon dioxide during the blast; thus getting the greater part of the heat at the place where it was needed, instead of going to waste in the carburettor and the superheater. The pressure at the grate-bars should be about 20 inches more than that at the top of the fuel; and the blowing machinery should be quite equal to maintaining such a result. Considerable development had been lately made in the improvement of large gas-engines; and in one city several such engines were used for the generation of electricity. There was room for great improvement in the handling and marketing of coke. This year they had made a radical change in the arrangement of the programme for the meeting, by taking important subjects for discussion instead of set papers. This feature was capable of considerable development; and if a member could do nothing else, he could suggest subjects that required discussion.

Gas Associations everywhere had already done much good work; and he thought their utility could be greatly increased by a harmonious plan of co-operation, under which each body could take up some particular department. Up to about ten years ago, their attention was almost exclusively occupied by engineering problems, and lately they had drifted to the commercial side. Some of the old school complained that no interest was taken in anything but the sale of gas. They were not entirely engineers, or wholly merchants; and each department should receive proper attention. Personally, he believed there was more money in the commercial than in the engineering aspect of the question. In large works, it was too much for one man to adequately superintend both departments. There were three Associations of a National character besides the District Associations; and if one of these could be devoted to engineering exclusively, and another to commercial considerations alone, it would be a great advantage. The membership would assume a more distinctive character, and greater *vim* and interest would attend the proceedings. Many of them were managers of a special department only in a large gas undertaking, and in attending general meetings had to sit through a great deal in which they were not interested. For instance, a gentleman engaged exclusively in engineering did not care to discuss accounts. In the case of an engineer and a secretary from the same company, both being members, they could not both attend the meetings; and it would be better if one went to his particular Association at one time, and the other attended his at a different period. An organization for engineering and research work exclusively was badly needed; and if the above suggestion was found to be impracticable, he was in favour of the formation of an Institute of Gas Engineers having that object in view. The Ohio Association was originally formed as a District Association; but its area of membership had since so greatly extended that it was necessary to consider and arrive at a definite conclusion as to its character and line of action. He also thought gas men might with advantage bring themselves into closer association with other branches of engineering. Modern demands for cheap fuel gas and other improvements necessitated a wider general and less exclusive kind of knowledge. Engineers of steel and glass works had made important progress in producer firing.

Gas companies might, he said, with advantage exercise care in employing well-educated and capable persons on the staff. Fuel gas was out of the question unless great and radical improvements in manufacture could be introduced, because 650 B.T.U. gas at 4s. 2d. per 1000 cubic feet was equivalent to coal at £10 per ton. There was room for great improvement in gas fires and heaters; and he had never seen any fuel-gas tests that were at all comprehensive or conclusive. As an illustration, he pointed out several defects in water-heaters as at present constructed—such as irregular rate of gas consumption, unsuitable draught, and loss by radiation. A gas-fire, to be effective, must discharge out of the flue the products of combustion with as little as possible of the heat, and a large proportion of the heat should be given off in the form of radiant energy. The use of regenerator flues as assisting in the development of a high-flame temperature would be an advantage. While the Association had very properly given prominent attention to commercial problems, he did not think they had neglected engineering questions. One of the best ways of reducing cost per 1000 cubic feet was by increasing the sales. To give an instance, he knew of two concerns that paid about the same

taxes and interest—the investment being about equal. But one required 1·3d. for rates and 11d. for interest, and the other 5d. for rates and 2s. for interest. The saving in the first case was simply the result of increased sales; and he knew of no similar source of economy at the manufacturing end of the business. He believed in free expenditure and pushing and advertising, but not free services, stoves, &c., because, if properly worked, this business could be done at a profit. If the main reason why gas was not used for cooking was the first cost of a stove, why had so little success attended the free-stove system? The object in view was to make people want gas-stoves; and every means available, whether personal canvassing or advertising, should be used to this end.

He advised the appointment of a Committee to consider the question of publishing their proceedings, and would not object to raising the subscription, if necessary, so as to secure that result, and make it optional to pay either 12s. 6d. (as at present) or £2, as he thought that all who could afford it would gladly pay the latter sum. It was usual for the President to undertake the work of reporting progress for the year; but it would be well to appoint a permanent Editor for this purpose—selecting a person in a position to give special attention to the subject. If any member wanted to do some research work, and did not know of a subject, there was the question of enriching gas with its own constituents. Methane could be made to yield acetylene by means of the electric arc, or by exposure to high temperature. The illuminants might first be washed out of the gas; then the exposure to heat or electricity might follow; and the illuminants could be returned to the gas by treatment at a high temperature with the heavy oils that had been used to absorb them when cold. Another important subject was that of the flow of gas at different pressures through pipes. The opportunity for work in chemistry, in combustion for heat or light, &c., was unlimited.

If the present departure in the programme proved unsatisfactory, he would suggest going back to papers; but, if so, at least two of the papers should be of a permanent standard character—such as a *résumé* of the development of each piece of apparatus used about a gas-works.

Novelty Advertising Suggestions.

The Editor of the Novelty Advertising Department—Mr. B. W. Perkins—submitted a report comprising seventeen items. Among other suggestions were advertisements on lamps, posters, waggons, banners, the backs of bills, in street cars, &c.; systematic canvassing on commission or otherwise; giving 1500 cubic feet of gas gratis to every new consumer; sky signs on the tops of gasholders; cooking classes, exhibitions, and distribution of free samples of coke; itinerant demonstrations in private kitchens or on the sidewalks; and one or two devices were decidedly eccentric in character. He said there was a great deal of novelty advertising that was as effective as newspaper advertising, and yet cost very little. The reading of the report was followed by a discussion, in the course of which some further experiences were related; and the President emphasized the importance of the department, and asked that it should be supported in every possible way, so as to enable those who had not the means of advertising in the usual manner to take advantage of novel and inexpensive methods.

Loose-Leaf Ledgers.

The question "Are Loose-Leaf Ledgers Desirable for Gas Companies' Records?" was next taken. Mr. A. P. Lathrop, of St. Paul (Minn.), said that, from personal experience, he knew of no system that would take care of the numerous details of gas-works operation so well as the card and loose-leaf system. It was specially adapted for application forms, meter-index records, service records, and such like. Even if cards were objected to, loose-leaf books could be used. He did not think much of the objection that loose leaves could be lost by negligence or dishonesty; but a more serious one was whether records of this kind would be accepted in the Courts as legal evidence. For consumers' ledgers, he had never been able to see any advantage in the loose-leaf system. Mr. Chas. S. Ritter, of Columbus, said that, whatever the system used, it must be simple, easily understood, and accessible. He went on to show that the loose-leaf ledger conformed to these requirements, especially if an addressograph was used. Loose-leaf ledgers had been forbidden in the banks, in consequence of a notorious case of fraud; but he thought that they could be made as secure against fraud as any other system. One serious disadvantage was the unsatisfactory means of taking the totals, which could not be kept with the ledgers, but necessitated the use of an adding machine and tapes, and must be filed separately. After all, bookkeeping was only common sense; and any system was as good or as bad as the clerks made it. Mr. E. W. Bell, of St. Louis, used loose-leaf ledgers extensively, and found them extremely desirable, thoroughly reliable, and economical. They afforded a satisfaction and perfection in accounting that could not be obtained with bound books. To guard against loss, his practice was to have all leaves numbered and signed by a responsible person; and the bookkeeper was held accountable for them. At any call from the auditor or secretary, the full number of leaves must be produced. He had not experienced trouble in the way of lost leaves. The loose-leaf consumers' ledger afforded the greatest saving, being arranged to correspond with the loose-leaf meter-index books, which could not be done with bound books. Mr. E. F. Lloyd, after some years' experience, believed in the loose-leaf system, with the solitary exception of the consumers' register. For this purpose, they were too cumbersome; and the usual form, having several names on one page, was more convenient for getting out the totals. The usual pattern sheet could be adapted to the loose-leaf system; but a leaf to each consumer was too much to handle. Mr. Ritter wished to add that he preferred bound books for permanent or long-standing accounts—such as consumers' deposits.

How to Deal with Complaints.

The next subject was "How may Complaints Best be Cared For?" Mr. Frank W. Frucauff, of Denver (Col.), insisted on the need for the systematic handling of complaints. His plan was to make one clerk responsible for seeing that all complaints were registered and properly attended to. He also used a return postal card, which was forwarded to each customer after the completion of the work; and he found this arrangement was highly appreciated. Mr. M. E. Malone, of Madison (Wis.), said that for the last five years he had adopted a very similar system—having all complaints properly registered under the control of one responsible clerk. His complaint men were provided with bicycles, which was a great advantage. He also used the return postal card; and it was an excellent feature. Mr. Ritter recorded complaints on loose leaves, and filed them in order; so that he could at any time turn up the complaints over several years past for a particular street or house. The advantages of such a plan were obvious. Mr. E. F. Lloyd used cards, 3 in. by 5 in., with printed headings, for the registration of complaints; and these were entered in duplicate—the card being retained in the office and the copy handed to the fitter or other workmen concerned. He, like the other speakers, used postal reply cards in every case. The complaint card was also ruled on the back, to receive details of labour and material used on the job, or other necessary particulars. The cards were filed in proper order for reference, either alphabetically or according to streets.

(To be continued.)

MANGANESE CARBIDE FOR GAS MAKING.

Manganese carbide, having the formula Mn_3C, was produced by Troost and Hautefeuille in a small blast-furnace, and was later made in the electric furnace by Moissan, who reported its properties fully in 1896. It interacts with hot water, and a mixture of equal volumes of marsh gas and hydrogen is evolved, according to the equation:—

$$Mn_3C + 6H_2O = 3\,Mn\,(OH)_2 + CH_4 + H_2.$$

It therefore differs from calcium carbide, in that it yields no acetylene, but instead a mixture of two gases, which are not formed from the calcium compound. This mixture would evidently serve as an excellent diluent for acetylene, which, in the undiluted state, is too rich in carbon to be readily burnt without smoke or deposit occurring. Hence several workers conceived the idea either of mixing the carbides before generation of gas, or of producing a mixed carbide, which on decomposition would yield a mixture of hydrogen, marsh gas, and acetylene in suitable proportions. Some curious and contradictory statements on the production and properties of such a mixed carbide have been made; but on the 5th inst., some more definite and authoritative information was laid before the London Section of the Society of Chemical Industry by Mr. J. S. Brame, in the form of a paper by himself and Professor Vivian B. Lewes on "The Mixed Carbides of Manganese and Calcium."

The authors first described their laboratory attempts at the production of a mixed carbide of manganese and calcium. The proportions of lime, manganese dioxide, and coke were varied as shown in the following table, which gives also the proportion of the gases which would result from the decomposition of the mixed carbide, which, according to theory, might be produced, and the proportions found from the actual product.

Parts of each Constituent in the Mixture used in the Electric Furnace.			Volumes per Cent. of Constituents of Gas.			
			According to Theory.		Actually Found.	
Manganese Dioxide.	Lime.	Coke.	Marsh Gas and Hydrogen.	Acetylene.	Marsh Gas and Hydrogen.	Acetylene.
2·5	1·0	1·5	51·63	48·37	44·08	55·92
5·0	1·0	2·5	68·16	31·84	84·20	15·80
7·5	1·0	3·	76·25	23·75	89·75	10·25

These results indicated that when the quantity of manganese in the mixture used was relatively small, the mixed carbide produced contained more calcium carbide than would be expected; while when the manganese was in relatively large proportion, there was more manganese carbide formed than would be required by theory. The results, however, became modified when working trials were made in the ordinary carbide furnaces at Foyers by the representatives of the Acetylene Illuminating Company.

When the proportion of manganese dioxide to lime was low, only calcium carbide was produced; but when the manganese dioxide was in considerable excess, only manganese carbide was obtained. Thus under neither of these conditions was a mixed

carbide formed. But it should be added that intermediate mixtures of the raw materials have not been tried on the large scale. The current employed was 1000 ampères, at 58 volts; the carbon electrodes being 6 inches square. There appeared to be little gain in efficiency unless the manganese was in large excess, when the yield per kilowatt hour was appreciably greater, as the following statement of the yield of the pure carbides would indicate to be probable:—

—	Current Used.			Kilowatt Hours.	Pounds of Ingot per Kilowatt Hour.
	Volts.	Ampères.	Kilowatts.		
Calcium carbide . .	57·0	870	49·6	188·5	0·34
Manganese carbide .	58·5	900	52·7	30·7	0·84

The manganese carbide made at Foyers is a metallic-like substance, with golden yellow to whitish fracture. It is quite stable in the air, and is very slightly, if at all, decomposed by cold water; but it is decomposed fairly rapidly by water at 160° Fahr. and upwards, yielding equal volumes of hydrogen and marsh gas. After making deduction of a little matter, which, as in the case of commercial calcium carbide, remains unacted upon, the yield of gas corresponds to about 98 per cent. of true manganese carbide; the remaining material being chiefly manganese silicide. Manganese carbide should theoretically yield 4·02 cubic feet of gas per pound; while a pound of calcium carbide should similarly yeild 5·59 cubic feet of acetylene. The fusing point of the manganese carbide is lower, which is an advantage from the manufacturing standpoint. The heat required for its production is theoretically 146,520 calories, against 197,200 calories for calcium carbide. It has a much higher density—viz., 6·89—whereas the density of calcium carbide is only 2·22. This difference may to some extent be responsible for the difficulty of obtaining the mixed carbides on a large scale. As matters stand at present, there seems to be no advantage in mixing manganese dioxide with lime for carbide manufacture, since the resultant carbide appears to be one of either metal, according to the proportions used, but never a mixed carbide. It is likely, however, that there may be a limited scope for the employment of manganese carbide for generating gas for the dilution of acetylene, as the generation could take place along with that of the acetylene.

There was no discussion of the paper at the meeting.

COKE MAKING AND THE RECOVERY OF PRODUCTS.

At the Annual Meeting of the Iron and Steel Institute in London last Wednesday the above subjects were dealt with in two papers.

In discussing the subject of the manufacture of coke from compressed fuel, Mr. J. H. Darby, of Brymbo, pointed out that the idea of compressing fuel for coking purposes originated on the Continent, where many of the coals coked so indifferently that it was of the greatest importance to adopt any method that gave a prospect of improving the quality of the resulting coke. It had been observed that the coke produced from the lower portions of retort-ovens, compressed by the weight of the superincumbent fuel, was superior to that produced from the upper portions of the charge; and this led to experiments in compressing the fuel. A numbers of samples taken from coking fuel in various parts of Great Britain were tried. Generally speaking, it was found that the weight of a given bulk of compressed fuel in an oven was 50 per cent. greater than fuel charged in the ordinary way through the holes in the upper portion of the oven and levelled by hand. Taking the side clearance that had to be allowed in introducing a cake of fuel into the oven, the net gain in weight that a given oven capacity would hold varied from 25 to 30 per cent. in favour of compressed fuel. But it was found that this fuel coked more slowly than the uncompressed; and the net gain in the production of coke per oven finally amounted to between 10 and 12 per cent. in favour of the compressed charge. To ascertain the difference in the character of the coke from compressed fuel compared with uncompressed, the weight of a cubic foot from a solid lump of coke was estimated; and it was found, in the case of three samples of fuel from Durham, that the average weight per cubic foot for the uncompressed coke was 63·37 lbs., and for compressed coke 80·88 lbs.; for North Welsh uncompressed coke, the average weight was 56 lbs. per cubic foot, compressed 60·57 lbs.; South Yorkshire uncompressed coke 53·9 lbs., compressed 57·9 lbs.; West Lancashire uncompressed coke 58 lbs., compressed 66·4 lbs. These figures showed that compressed coke was considerably denser, in addition to which other advantages were noted. These were: (1) The breeze was much reduced in quantity, the lumps of coke were larger and firmer, and in a marked degree bore handling without very much breakage. (2) The process of charging an oven by the mechanical means in use where compression of fuel was adopted, occupied much less time than the old method of charging by hand—in fact, the time was reduced from 10 or 12 to 3 or 4 minutes; so that the objectionable smoke was largely prevented, and the loss of bye-products was less, while in some cases the yield of ammonia had been increased by 25 per cent. (3) Less hand labour was employed, and the labourers' work of forcing the wet fuel out of the tubs into the ovens, and levelling the charge in the ovens, was entirely abolished. The results obtained showed that the quality of the coke was distinctly improved by compression. Such improvement was naturally more marked in some fuels than in others; but from a large number of trials made, he was able to say that he had not seen any instance in which the improvement effected by compression had not been apparent. The essential parts of the appliances used were the stamping machines and the compression boxes. Under favourable conditions, the machines would compress and charge 50 ovens per 24 hours, and it was probable this was not the limit of the modern machines.

Mr. J. Thiry, of London, contributed a paper on the recovery of bye-products in coke making. He said that in this country, where the use of coke for the beehive oven still continued much in favour, an increasing interest had lately been manifested in the new methods of coke production, and a number of plants had been erected which embodied many of the most recent improvements. Much credit was due to Evence Coppée, to the late Henry Simon, and to Mr. Darby, the pioneers of the modern system in England, for having succeeded, in spite of much opposition, in establishing retort and bye-products ovens in this country—the first-named having put up some 2000 ordinary retort-ovens, and the two last together about 1400 bye-products ovens. In the new system, there was obtainable an increased yield in coke and products without special provision for pre-heating the air for compression. He regretted that he was unable to furnish data regarding the cost of production in England, as he had hitherto had no opportunity personally of working an installation in this country; but, from all the information he had been able to gather from ironmasters who owned these ovens, he was in a position to assert that the cost of labour was no higher than that for working the beehive oven.

In the subsequent discussion, Mr. Snelous said he had had the privilege of seeing Mr. Darby's process carried out, and he regarded the result as one of the greatest improvements which had been made in the coking of coal for a very long time. At Brymbo the coal was not of good quality, but it made splendid coke, which was of bright appearance, and very similar to that from the beehive ovens. The essence of the whole thing was the compression of small coal outside the oven. He had seen a great many coking plants, but none that gave better results than those at Brymbo. Dr. Ludwig Mond also congratulated Mr. Darby upon the results of his experiments. The process must, he thought, lead to better results.

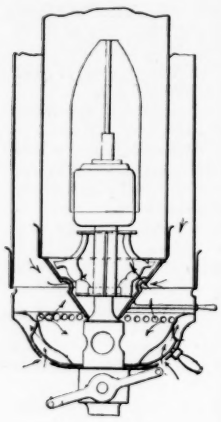
AN UNFORTUNATE EXPERIENCE WITH CARBON MONOXIDE.

The industrial applications of carbonic oxide outside gaseous furnace working are so few, that special interest attaches to the record of the attempt of Messrs. A. L. & A. W. Lawton, of Brooklyn, to use it as an agent for preserving fruit during a sea transit through the tropics. Unfortunately, the only experiment with the process on a working scale that appears to have been made resulted in a fatal explosion on board the steamship "Para," in November last, according to a Board of Trade report just issued. The principle of the process consisted in keeping the fruit in an atmosphere heavily charged with cooled carbonic acid. The gas was made in this instance in a coke-fed producer, 3 ft. deep and 9 in. diameter. The gas was driven off by means of a steam-blower, was purified over wet sieves and lime, refrigerated, and led by a 4-inch pipe into the fruit chamber. This chamber was of considerable size, was lagged, and not lighted except through glass windows. The deck outside it was lighted by electricity. The apparatus was worked in a simple way. The fire being lighted and the producer filled with coke, an air blast was passed through it—the top being open—until the body of coke was thoroughly incandescent. Then the escape valve was closed and the valves reversed, so that the producer gas was driven into the chamber as described. When the process was started, on the ship leaving Jamaica with bananas in the chamber, all went well for a couple of days. It took about 45 minutes blowing to burn away all the charge of coke; and as soon as this was done, the current of gas was altered, the producer opened, and a fresh charge of coke put in. The fan never stopped, and as soon as every fresh charge had become red-hot through, the gas was sent into the chamber as already stated. Eventually the chamber was seen to be full of smoke; but blowing went on after this. During the next reversal, however, while the valves leading to the chamber were closed, a violent explosion occurred in the chamber, accompanied by a dull red flash of light. Three persons were killed and much injury done to the internal fittings of the ship by the explosion. Captain Thomson, His Majesty's Chief Inspector of Explosives, says that in the circumstances an explosive mixture of gas and air was certain to be found in the chamber sooner or later. Dr. Dupré has found by experiment that such a mixture begins to be explosive with 0·80 of carbonic oxide to 1 of air, being most violent at 1¼ of gas to 1 of air. With 3 of gas to 1 of air the mixture again ceases to be explosive. Ignition was caused by a spark from the electric light fittings of the ship; how it is impossible to say. This is the more to be deplored, as Captain Thomson thinks the process might well be carried out on board ship without serious risk, if certain precautions are observed.

REGISTER OF PATENTS.

Gas-Burners.—Abraham, F., of Berlin. No. 7723; April 15, 1901.

This invention in atmospheric burners has for its object to provide means "for effectively heating the air required to support combustion, so as to secure perfect combustion in the flame."

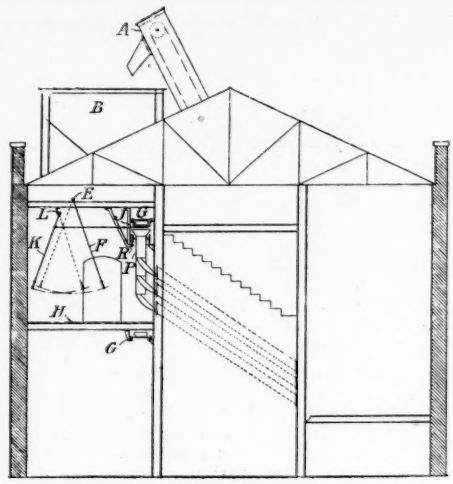


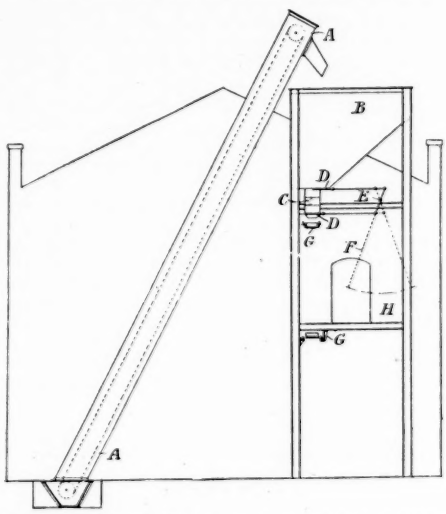
A double supply of air is provided—the first for the mixing-tube, and the second supply for admission between the inner cylinder or chimney and the head of the burner. This arrangement involves the employment of a shorter outer cylinder around the ordinary cylinder or chimney. The gallery to the gas-tube stem has a ledge or support for the reception of the outer cylinder, and the lower part of the gallery is provided with an annular space into which air is admitted by means of a valve—the air finding egress through a circumferential series of holes into the space between the outer and inner cylinders or chimneys. The mixing-tube (as shown) is disposed within the gallery supporting the outer cylinder; and upon it a funnel-shaped gallery is provided for the support of the inner cylinder or chimney. The funnel gallery has a series of holes, through which air is admitted to the burner or mantle, and is provided with an exterior valve part, so that the air-passages may be closed or their opening regulated as required. The burner is fitted to the mixing-tube, and carries the mantle in the usual way.

Measuring, Conveying, and Charging Coal into Inclined Gas-Retorts.—Blake, M., and Smart, R. H., of Greenock. No. 9240; May 4, 1901.

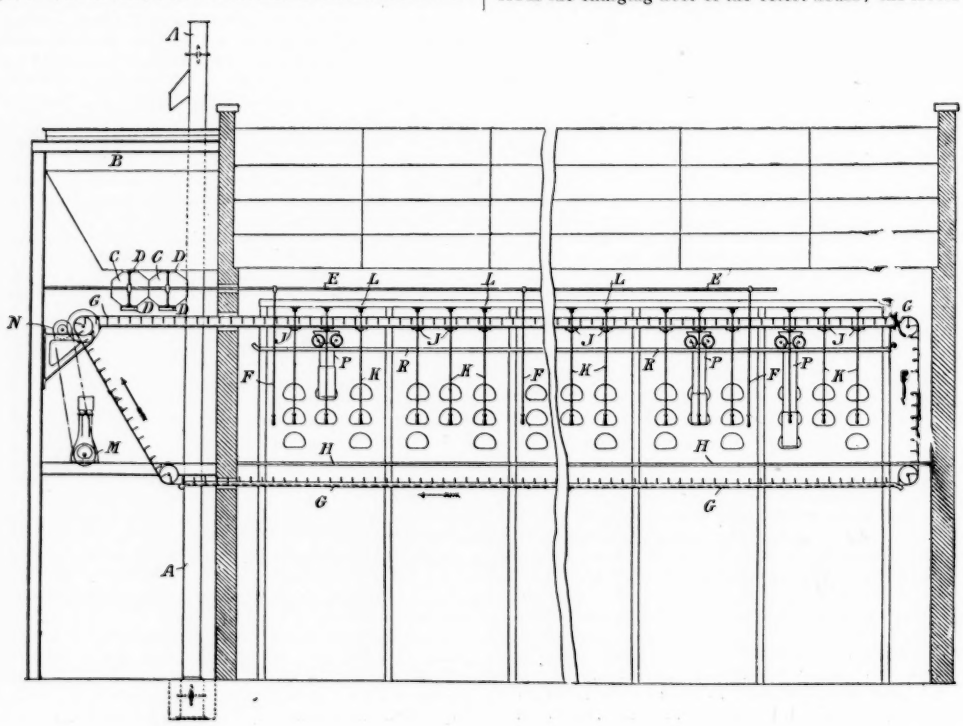
This invention has reference to a combination of appliances for measuring, conveying, and charging coal into inclined gas-retorts. A longitudinal section, a cross section, and an end elevation of such a retort-house (reproduced from the specification) show the application of the conveyor from the measuring-boxes under the main storage hopper to the portable trolley, fillers, or charging shoots, over the retorts.

The coal to be carbonized is elevated from a single or double elevator A, of inclined, curved, or vertical type. From the elevator the coal is deposited in a main storage hopper B, which may be located outside the gable wall of the retort-house, and at the necessary height from the ground level to enable the operations described to be properly carried out. On the underside of the hopper B, and affixed to it, are two measuring boxes C, one of which may be in constant operation, the other being provided in case of a breakdown—the slides being disconnected when it is not in operation. The measuring boxes are provided with overlapping slides D at their lower and upper ends. These slides (as shown) are operated by one single fulcrum or rocking shaft E, preferably extended into, and along the entire length of, the retort-house. Upon the shaft are fixed, at convenient distances apart, hand levers F, by pulling which the slides in the measuring boxes are operated, and the coal deposited upon the conveyor. Underneath the measuring boxes is a conveyor G, which would take measured quantities of coal into the retort-house. The conveyor would preferably be of the "scraper" type, and, as shown, with double endless chains and transverse ploughs or scrapers attached to it at suitable distances apart. Either single or double sliding or rolling chains inside or outside the trough may be employed; or double chains supported on rollers outside the trough. The return chains and ploughs or scrapers G are shown returning under the firing-floor H.





On the underside of the conveyor trough, at certain distances apart, a series of openings and slides J are arranged; there being one opening and one slide for each vertical tier of retorts in each oven. The slides are actuated by connecting links and hand-operated levers K from the charging-floor of the retort house; the levers K having their



fulcrum at L. The conveyor is shown driven by a vertical steam-engine M, through suitable countershaft and gearing N.

Immediately underneath the conveyor trough, and under the openings and slides J, portable trolley fillers or charging shoots P, of varied vertical lengths, are arranged to run on rails R—one particular length of filler or shoot being used for each particular level of retorts; or a single combination filler or shoot may be employed for charging a considerable number of retorts at different horizontal levels, if it be capable of telescopic or like adjustment.

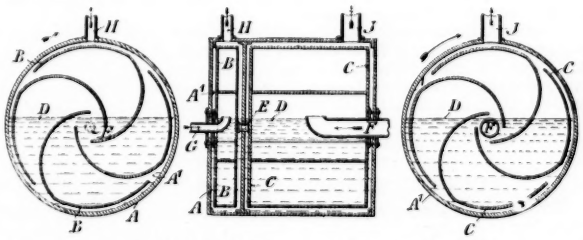
When it is desired to charge any particular retort, the portable trolley filler or charging shoot is run along the rails until it is exactly vertically over it, and the slide of the conveyor trough immediately above it is pulled open by means of the lever. The attendant will then pull one of the levers F, which will actuate the slides D in one of the measuring boxes C, and thereby deposit a measured quantity of coal on the conveyor G, which, upon being travelled along the trough, will be discharged through one of the openings in the trough into the portable filler or charging shoot P, and from thence into the retort.

Supplying Gas and Air to Atmospheric Gas-Burners.—Stevens, J. H., of Bedford Park, W. No. 9660; May 9, 1901.

This invention is said to comprise two essential points: (1) The application of the initial pressure of gas as supplied in the mains as a means of conveying air under pressure to an atmospheric burner. (2) An atmospheric burner having the mixing-chamber entirely closed against the immediately surrounding atmosphere—the air being conveyed to the point of ignition under pressure.

The advantages claimed for the invention are that an atmospheric burner so constructed and supplied (especially in connection with incandescent gas lighting) will give an intensified duty, will not light-back, and that the air and the gas will be supplied in constant relative proportions, and both under pressure, without the aid of any other element or outside mechanical force. In high-pressure gas lighting, as heretofore practised, says the patentee, the normal pressure of the gas has been raised; the gas being expelled through a jet or jets into a chamber open to the surrounding atmosphere, and into which air is drawn merely by the force of the velocity of the gas as it rises in the mixing-chamber, and is consumed by the burner. In other words, when the gas issues from the mixing-chamber, the initial pressure is lost. With his invention, however, the initial pressure is carried to the point of ignition, besides being further utilized to convey air under pressure to the mixing-chamber.

A modified form of wet or dry gas-meter, or any instrument capable of measuring liquids or gases supplied under pressure, will answer the purpose, a simple method for which is illustrated by the annexed sectional views.



Concealed in a suitable chamber A, which may be in the top of a street-lantern or at the base of a lamp-column, and divided into several compartments, are placed suitable drums B C. These are partly submerged in water, as shown at D, contained in the chamber A, which is air-tight. The gas entering at G, in passing through the compartment A^1 of the chamber A to the pipe H (which leads to the supply of the burners), revolves the drum B (just as is the case with a wet gas-meter) with a power, and at a rate, corresponding with the initial pressure in the gas-main, and the amount of gas that passes. This power is used to convey the air in the correct proportion to the mixing-chamber of the burner. To accomplish this, the spindle E on one side of the drum B is extended into the adjoining compartment (also half water), having an inlet F from the surrounding atmosphere. To this extension of the spindle is attached the drum C, having compartments of larger capacity (say, 6 to 1) than those of the drum B, through which the gas alone passes. As the drum C revolves in unison with the other one driven by the initial pressure of the gas, it takes in air and conveys it in a similar manner (but by a separate tube J) to that by which the gas is supplied to the burner. Both the air and gas so passing through this contrivance meet in correct proportions in the mixing-chamber of the burner; and this chamber being air-tight, both are delivered at equal pressure at the points of ignition. In this way, the correct predetermined proportion of air and gas must always be maintained, whether the consumption of the burners supplied be much or little, as the greater the consumption the faster will the drums rotate, conveying gas and air in constant proportions to the mixing-chamber, and thence to the points of ignition.

As applied to apparatus similar to dry gas meters, the invention consists of two or more diaphragms working alternately and in a similar way to the diaphragms of a dry meter, but each being divided into two compartments. The smaller takes in and expels gas, the larger takes in and expels air as the diaphragms expand and contract, actuated by the initial pressure of the gas as admitted from the main or service. As in the mechanism already described, the air and gas passing through the apparatus will be conducted, by separate channels or pipes, to a mixing-chamber, and thence to the point of ignition under equal pressure.

Fastening and Releasing the Covers of Gas Purifiers.—Milbourne, R. J., of Wellington, Salop. No. 11,352; June 3, 1901.

The object of this invention is to arrange that one operation will secure, and one operation will release, all the fastenings of purifier covers.

Along the sides of the cover are arranged rotatable shafts, each fitted with eccentric discs encircled by straps carrying the fastening clutches, which secure the cover by engaging underneath a flange around the opening to be closed. The shafts are geared together at their ends by bevel-toothed wheels secured to the ends of the shafts, so that motion imparted to one shaft will cause the other shafts to be operated also; and as the eccentric discs are moved with the shafts, the clutches are (according to the direction in which the shafts are operated) simultaneously moved into their closing position, or into their releasing position, and the cover is fastened or unfastened. The periphery of each eccentric disc may be provided with a projection or tooth, which engages with a stop in the strap of the clutch, so that when the clutch reaches its lowest position, a rotary movement is imparted to it to raise it out of the way of the flange, so that the cover can be freely raised and removed.

Fig. 1 is an elevation, and fig. 2 a plan, of a cover provided with means for fastening it to, and releasing it from, the opening in the upper part of a purifier. Fig. 3 is a transverse section (enlarged scale) showing one of the fastening catches in the position in which they

Fig. 1.

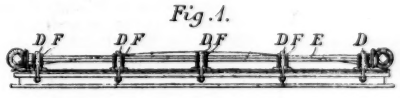


Fig. 2.

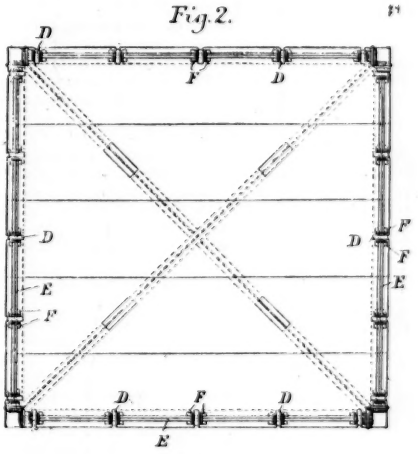


Fig. 3.

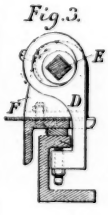


Fig. 4

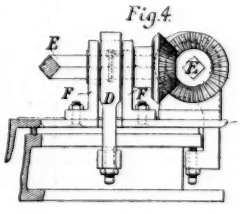
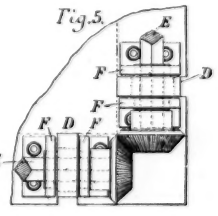


Fig. 5.



secure the cover in place. Figs. 4 and 5 are an elevation and plan of one corner of the cover and its attachment, showing two of the catches, and the manner in which the shafts are geared together at each corner.

The rotatable shafts E carry eccentric discs, so that they are partially rotated with the shafts. The discs are encircled by eccentric straps formed on the upper part of the catches D, the lower part of the catches having inward projections for taking under the flange of the purifier; the projections being preferably provided with screws for adjusting the part which bears upon the underside of the flange. The shafts are geared together by bevel-wheels secured to the ends of the shafts. The shafts may be round, and mounted directly in the bearings F bolted to the flanges of the cover, and the eccentric discs be keyed or otherwise secured thereto; but the shafts are preferably square, and eccentric discs are provided with rounded parts to turn in the bearings F—the square shafts passing through square holes in the discs and rounded parts as shown. There is a screw in each of the eccentric straps and a groove in each of the eccentric discs constituting the arrangement of projection or tooth, and a stop (already referred to) for turning the ends of the catches clear of the flange. When the eccentric disc is rotated in the direction of the arrow in fig. 3, the end of the slot shown, by coming against the screw, causes the strap D to move with the disc and remove the lower end of the strap from beneath the flange, and so release the lid. When the disc is turned in the reverse direction, the lower end of the strap will fall by gravity into position beneath the flange, and be tightened up by the further rotation of the disc in the strap.

The patentee points out that, by the arrangement described, the catches, being all carried by the cover, are, when the cover is removed, taken clear of the purifier, and are kept out of the way of the operators, and also clear of the purifying material, while the whole of the catches are, by one operation, brought to the position in which they secure the cover by giving partial rotatory movement to either of the shafts E, and by a similar single operation of either of the shafts in the reverse direction the catches are released.

Incandescent Mantles.—Wilson, J., of Birmingham. No. 12,137; June 14, 1901.

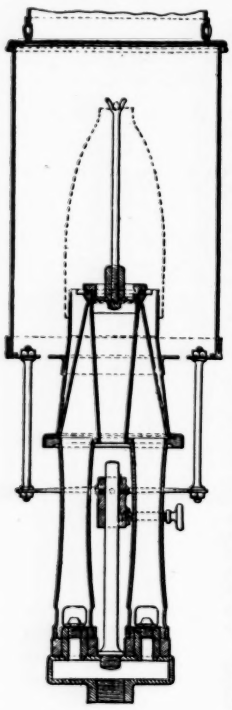
The patentee points out, as is well known, that incandescent mantles made of the oxides of thorium and cerium are exceedingly fragile; and

it has been found that other salts of these metals give, when heated, an equally powerful light, while the ash in some cases remains harder, thereby rendering the mantle much more durable. This is particularly so in the case of salts containing phosphorus in combination with other elements, such as the phosphate and pyro-phosphate, which he proposes to substitute for part of the oxide.

He takes a solution of nitrate or other salt of thorium in either spirit of wine or water, or a mixture of the two. To this he adds a small quantity of phosphate of cerium, not exceeding 2 per cent. If preferred in solution, this may be dissolved in any suitable acid—preferably hydrochloric. Into the mixture thus prepared the fabric is dipped, and afterwards dried and calcined in the usual manner.

Incandescent Burners.—Brett, G., of Finsbury Park, N., and Henneberger, F., of Pimlico, S.W. No. 12,259; June 15, 1901.

This is the burner described in the "JOURNAL" for the 29th ult., p. 1082, and little need be added except to reproduce the section of the burner appearing in the patent specification, and to point out again what it is the inventors aim at accomplishing.



The invention relates to an improved gas-burner of the incandescent type, and has for its object the construction of a lamp which will give a high efficiency with the use of a mantle of moderate size, without any special provision for increasing the pressure of the gas. In modern burners, the patentees point out, the best practice is to form the bunsen tube as a double truncated cone—the two cones being united at their apices; and to arrange the size of the head of the burner so that, as far as possible, all the air necessary for the complete combustion of the gas is drawn into the burner with the jet of gas, and a self-burning mixture, practically independent of the supply of air outside the flame, is obtained. With burners of this description, in order to allow the passage of a sufficient quantity of gas per hour at ordinary pressures to yield a high lighting duty, the size of the head of the burner necessitates the use of mantles of such dimensions that the manufacture of them is attended with some difficulty, and the maintenance of the mantles becomes a question of some cost. This invention therefore relates to a construction of lamp such that a mantle of moderate size can be employed, and yet the volume of gas consumed, and the consequent amount of light produced, are much greater than can be obtained even when mantles of the largest practicable size are employed with gas supplied under forced pressure.

They claim as their invention: "An incandescent gas-lamp comprising several bunsen tubes of double truncated cone form arranged on a hollow base, and opening at their tops into a single perforated metal cone within a casing terminating in a burner and containing a central air-tube, comprising also a support for a refractory mantle and a gallery and tall chimney partly of glass."

APPLICATIONS FOR LETTERS PATENT.

9150.—NORTH, S. W., "Turning-on gas, electric current, water, and the like, at predetermined times." April 21.

9155.—PLATT, J., and PARTINGTON, G., "Fork for supporting incandescent mantles." April 21.

9198.—BERTHOLD, C. E. J., "Manufacture of pellets for the self-ignition of gas." April 21.

9256.—HERON, C. M., "Glass shades for gas lights and other purposes." April 22.

9322.—LAKE, H. H., "Manufacture of coal tar compositions and pitches." A communication from F. J. Warren. April 22.

9339.—NORDMANN, R., "Incandescent mantles." April 22.

9347.—BELLAMY, A. R., "Gas and similar internal combustion engines." April 23.

9356.—HAYWARD, F. W., FOX, R. C., and WILKINSON, E., "A new inflammable and explosive gas suitable for internal combustion motors and other purposes." April 23.

9363.—POOLEY, C. A., "Internal combustion engine." April 23.

9407.—SMITH, W. & J., "Gas heating apparatus." April 23.

9411.—METROPOLITAN GAS-METERS, Ltd., and FORSTER, J. D., "Prepayment gas-meters." April 23.

9412.—LANGHANS, R., "Manufacturing metallically skeletonized earthy incandescent structures for producing light." April 23.

9421.—LUCHAIRE, H. S. A., and LECOMTE, A., "Incandescent railway and other lamps." April 23.

9437.—COEQUYT, A., "Air or gas compressors." April 23.

9465.—MUIRHEAD, W. M., "Water-meters." April 24.

9534.—DOWSON, J. E., "Manufacture of generator gas." April 24.

9593.—BARKER, R. W., "Ventilating and lighting rooms." A communication from L. H. Hammitt and O. A. Braseth. April 25.

9598.—WINAUD, P., "Rapidly producing a gas suitable for driving gas-engines." April 25.

9612.—BERTHOLD, C. E. J., "Automatically igniting gas-jets." April 25.

9613.—BERTHOLD, C. E. J., "Gas-burners." April 25.

9622.—TREWBY, G. C., "Gas-retorts." April 25.

9641.—WINDHAM, F., "Acetylene generators." April 25.

9660.—DOMAN, W., and JONES, W., "Washing and purifying gases." April 26.

CORRESPONDENCE.

[We are not responsible for opinions expressed by correspondents.]

The Incandescent Mantle Settlement.

SIR,—I should not have noticed the letter of Mr. Edwards Radclyffe in this week's "JOURNAL," but that it is clear to me that he means to be troublesome. I, therefore, ask your permission to say what I know of his position in regard to the Welsbach negotiations.

The first I heard of him was *after* the Guarantee Fund was started, when he called to see me; but, I being away, he made some mysterious communication to Mr. Carpenter. Immediately the fund was started, I wrote to the Chairman of the Welsbach Advisory Committee, who sent a very friendly response; and the Chairman of the Welsbach Company (Mr. Williamson) asked for an interview, which took place before I had seen Mr. Radclyffe. The latter, in the meantime, I believe, had seen Mr. Cave, to whom he was equally mysterious. Since then Mr. Radclyffe has made many calls upon me, and has written numerous post cards—sometimes two in a day. Last week he wrote me a letter, stating that he had been the intermediary to bring the parties together, and claimed a substantial payment from the Guarantee Fund for his so-called services in bringing about the settlement. I requested Mr. Bush to write stating that I could not entertain his "utterly groundless and absurd" claim, and that I could hold no further communication with him. He appears to have written to you about that time; and to-day another letter came from him, asking me to reconsider his claim, which is quite out of the question.

Mr. Radclyffe never gave me the names of any of the members of the mantle trade for whom he professed to be acting. He certainly did not "bring the litigants together," nor did he (so far as I know) act "as an intermediary." There was, in fact, no room for any intermediary—all the principals being ready and willing to meet; and they did meet as the direct result of the invitation of the Welsbach Chairman to me.

So far as I am concerned, the first to move in the matter was Mr. Schultz, of the Guaranty Mantle Company, who near the end of last year suggested that I might help towards a settlement. We had two or three interviews; but the way was not clear. Early in February, the Guarantee Fund was started; and after that I met Mr. Keith, to whom much is due especially for his assistance in getting evidence, and in introducing Mr. Cave as the Solicitor. The settlement is due to the reasonableness of Mr. Williamson, representing the Welsbach Company, Mr. Schultz, of the Guaranty Company, the Voelker Company, and Mr. Keith, and not least to Mr. Cave, the Solicitor to the defendants; while so far as these gentlemen were concerned Mr. Edwards-Radclyffe was nowhere.

May I add the hope that the Boards of Gas Companies and the Committees of Corporation Gas Undertakings will give a friendly reception to the suggestion that they will come into the settlement, by sealing the agreement, copies having been sent to them for that purpose. They will certainly find it better than remaining outside the arrangement.

GEORGE LIVESEY.

May 8, 1902.

Carburetted Water Gas as an Enricher.

SIR,—Surely Mr. Glasgow does not expect me to accept his revised criticism ("JOURNAL," May 6, p. 1194) of my paper read before the Institution of Gas Engineers as a formulation of the grounds on which he stated a week before my paper was read that 16-candle gas could be made for 1s. per 1000 cubic feet. That is the sole question I asked, when I disputed his right to criticize the action of the responsible advisers of the Companies who have obtained a reduction of the parliamentary standard of illuminating power. Will he kindly answer it?

As to his further observations about my paper, when I have carried my investigations farther, I shall be very glad to make the results known whether they are for or against my theories or those of Mr. Glasgow.

HY. E. JONES.

Stepney, E., May 9, 1902.

The Position of "Sons of the Gas Industry."

SIR,—During the last few weeks, you have commented upon the above; and in your issue of March 18 you fully reported our proceedings, when we took the matter up, notwithstanding you have so many claims on the space of your valuable paper. May we thank you for taking the subject so seriously, and giving us your kind assistance.

In your leader of April 8, you state that your "Correspondence" columns are open to the juniors of the profession. Since then nothing has been done; and no one has seemed to take the advantage. We thought therefore we had better make another appeal to them, before letting the matter drop, so that, if possible, we may gain some further point that will do material good to the "Sons of the Gas Industry."

We, as an Association, are taking up the matter very energetically, with a view to improving not only our position as an Association, but also of assisting by means of increased knowledge and experience in practical as well as technical matters. Our Association, we boldly state, comprises young men who occupy important positions in connection with gas manufacture and distribution; and to bring them out we have papers read and discussions thereon, visits to works, &c., items of which are doing an immense amount of good. But what they want, or now need, are the views of those of older experience than themselves; and this can only be derived from the assistance of the senior Associations.

Since the commencement of the Association, now four years ago, nearly all the papers have been contributed by our own members, and what we suggest is that the seniors should depute some of their number to come among us at stated intervals, and give us (in the shape of lectures, or in any other manner preferable to them) the benefit of their varied and ripe experiences in their struggles to maintain the supremacy of the Gas Industry—gentlemen with whom we can

discuss without any loss of dignity to the seniors. Then if the seniors are satisfied after the report that ample talent is forthcoming, let them devise further measures for availing themselves of it. It may be added that we have now sent to the senior Association, copies of the resolution passed at our meeting on March 15; and we shall no doubt hear from them in due course.

We may take this opportunity of thanking the few senior members of the profession who have shown that they coincide in our views by allowing us to visit their works.

We trust that this letter will encourage other expressions of opinion from the gas profession (both junior and senior), so that we can continue to press forward in the work we have in view.

For the COMMITTEE OF THE MANCHESTER AND DISTRICT JUNIOR GAS ASSOCIATION,
ERNEST J. WELLENS, Hon. Sec.

Middleton, May 5, 1902.

The "Positive" Meter.

SIR,—In accordance with a suggestion made by you, in the "Editorial Notes" of the "JOURNAL" for April 22 (p. 1006), I went to Grantham by appointment on the 30th ult., to make a further test of the meter, No. 5177, in conjunction with Mr. Shadbolt. We continued the tests for nearly three hours, at pressures varying from 3-10ths to 5½ inches, and at different rates of consumption, from 1 foot to 48 feet per hour. The meter worked satisfactorily the whole of the time; and Mr. Shadbolt said it had been working for five days and nights, from a tip-light to 30 feet, without ceasing to register—in fact, since the Boston meeting it had not stopped once. After our test, it was agreed that I should leave the meter with Mr. Shadbolt another week; and then, if it went wrong during that time, it was to be sent to a certain testing office for separate test and report. In the meantime, the valve-box was not to be opened.

On May 4, Mr. Shadbolt wrote me that the meter had stopped in a similar manner to that described at the Boston meeting, and asked me to again visit Grantham to see it. Unfortunately, I was ill in bed; but I sent our Works Manager by first train, with particular instructions that on no account was the valve-box (or anything) to be altered. On his return next day, he reported to me that he found the meter stopped as described by Mr. Shadbolt; also that they had both noticed that one valve was lifted nearly $\frac{1}{32}$ inch off its seat. They had thereupon decided that, as this was apparent through the glass valve-box top, they had better open it and find the cause. On examining the parts carefully, a small rough place, or tool mark, was found on one of the valve hooks, and a slight burr on the side of the hole of the valve-arm which worked on the hook. Occasionally, in working, these two rough points seem to have come into contact; and this of course easily accounts for the valve being lifted off its seat.

The cause of the trouble is thus shown to be careless fitting on the part of a workman, and is not connected with the principle of the meter. The valves are the same as in a dry meter, and the same fault occasionally occurs in the dry; but it is not the meter (in either case) that is to blame, but careless fitting on the part of the workman. It is the only case we have had.

On account of illness, I have not personally seen the meter since I was at Grantham on April 30; but the above seems to me the only possible solution of the faulty working of this particular meter. We shall re-fit the valve, and then I am sure Mr. Shadbolt will find it satisfactory in every way.

JOHN GREENALL.

Leeds, May 9, 1902.

P.S.—I understand Mr. Shadbolt is sending a separate report.—J.G.

The Mental Bias of the Day.

SIR,—While lunching with a gas engineer from Boston a few weeks ago, I took an opportunity, and inquired of him what in his mind's eye loomed largest as the special character of the present development in gas affairs. He answered: "The negation of experience. There is nothing more noticed among the younger men to-day than their absolute determination to be held in the background no longer than they must be. The young men who consent to remain in subordinate places are now, and from now onwards you will see will be more and more, men who, for some reason known to themselves, lack confidence in their own future. The men who believe in themselves will now more than ever try to break new ground—to do some new thing." I naturally asked why; and his reply was as follows: "The gas business in this country until a few years ago was in the hands of a multitude of small local corporations, each one existing for its own locality, and guided in its business by its own local needs. Now these are being rapidly combined and systematized; and before long there will be only (say) a dozen men in the really responsible places, and initiative will be lost to all but a few. Say that twenty gas-works are combined under one management. This stands for one general super and twenty local managers. Now, what kind of men are you going to have for those local managers? Not the present incumbents. You will not find in them one of the desired qualities sought for by the new owners. The new local men will be the *protégés* of the new owners, and will not owe their positions to experience, but to fitness for the new conditions—qualities quite wanting in the older men. A good chance for young men! Yes, indeed, for some young men—for the nephews and the husbands of the nieces of the new owners; but not good enough for the sons, nor even for the sons-in-law, of the big men. These places are just about the right size in responsibility and salary for someone who must be 'provided for in some way.' I tell you, we are beginning an era of nepotism gone mad."

I reminded him of his own situation, and he answered: "Don't you suppose I know it? What would it amount to if my precious uncle was not the president of both these companies. Just please to remember that I learned all I know about gas making after I was twenty-five, and I am not thirty yet. I went to Europe just after I graduated; and after I was there, received my orders to 'do' a certain set of gas-works instead of what had been planned for me before I left. I did as I was told—made reports on the works, got some hints that the reports could be improved, did better, and here I am. Now, just tell me if this is not the negation of the value of experience? Do you think that if a boy like me is put over the head of a man worth his salt, that the man he supersedes is going to stay any longer than it takes to find a new place? Of course, he is not. But the new places are going to be less in number every year, as the nephews are educated to fill them; and then by-and-bye some other fellow's uncle wants my place for his nephew, and it is my turn to find a new place, unless I have invested enough in the company to hold my own. Not a bit of it; there is no chance for a deserving young man. Take that young fellow at Ann-Arbor. Do you think he has any better chance because he had that scholarship? Not a bit, unless the men who have bought him have run out of poor relations with an education. Of course, I admit the education; but the men will be educated for the place in the gift of the family, just as young men are said to be educated for the family 'living'—is that what you call it?—in England."

This struck me as being an interesting view of the future prospects for the educated specialist. "Family gas-works" is good.

E. W. H.

New York, April 29, 1902.

The Use of Bitumen.

SIR,—Some attention has been recently drawn to the explosion in electric boxes, due to the gases produced by the melting of bitumen; and it occurred to me that it would not be out of place to give a few facts relating to this material—but more especially regarding its use in buildings and reservoirs. The great risks that are being run by water engineers is apparently not appreciated.

There is no doubt whatever that the bitumen sold under various trade names—such as mineral bitumen, pine bitumen, &c.—deteriorates. It may not be generally known to many of the users of this material that it is produced by boiling Trinidad or similar asphalt in its crude form—that is, containing a large proportion of earthy matter—with oil or grease in various proportions according to the season; oil or grease giving the ductility to this material, which would otherwise be brittle. The grease generally used (owing to cheapness) is of American origin, and varying quality. As this material is affected so quickly by cold and heat, it is necessary to add about twice as much grease in winter as in summer to prevent brittleness; the average being about one of grease to six of crude asphalt. This peculiarity has far-reaching and somewhat alarming results—as, for instance, when it is used as a damp-proof course in walls. In several cases, the walls have moved on the "winter make" as soon as the full effect of the summer heat became perceptible; and in others the material has simply run out on either side of the wall, leaving nothing behind except a little bitumen in a brittle state.

Now as regards its deterioration, there are numerous instances. In one case, an architect in Essex decided upon using bitumen as a damp-proof course in some buildings, and a few years afterwards had occasion to make certain alterations which involved removing a portion of the walls, with the startling result that the bitumen (or as much as remained) consisted of a hard fragmentary material, from which all the oil had evaporated. It was thus entirely defective for the purpose for which it had been used. These examples could be multiplied; but if engineers and others will carefully investigate, they will find full confirmation of the warning given.

It is true that apparently good effects have temporarily resulted from using bitumen; but have engineers and architects inquired and investigated the failures? It is a pity that for some reason or another the numerous failures have not been thoroughly sifted before several engineers have advised its use, as there will be a rude awakening some day, with disastrous results.

Many electrical engineers are now using a prepared coal-tar pitch in preference to bitumen, as it is equally as good when properly prepared.

It is worthy the careful consideration of water engineers whether fine gravel concrete and cement rendering, or good puddle, although somewhat old-fashioned, are not likely to be found to be the only reliable watertight mediums, and not be led astray with so-called guarantees of bitumen.

J. W. MARTIN.

Cheltenham, May 6, 1902.

Progress of the Mond Gas Scheme.—At the last monthly meeting of the South Staffordshire Mines Drainage Commissioners at Dudley, Mr. R. Williams wished to know what progress was being made with Mond gas, which, it was said, was to be the salvation of the district. Not only did they hope to have motive power at a less cost, but they wanted to get rid of the smoke. The Chairman (Mr. J. B. Cochrane) said Mond gas was going forward. The gas itself could be made very quickly, but the construction of the plant took a great deal of time. The land had been bought for the first installation, and the plant for it had also been arranged. He did not think it was likely there would be a supply from the first plant for eighteen months or two years.

Tarapaca Water-Works Company.—Sir Robert Harvey presided, on the 5th inst., at the fourteenth annual meeting of this Company, held at Winchester House, E.C. He said the falling off in the net revenue of about $5000 was due principally to the decline in the rate of exchange. The accounts had been made out at 1s. per dollar; whereas the rate of exchange last year at the same time was 17½d. Notwithstanding the decreased traffic on the Nitrate Railway, which was one of the Company's principal customers, and the smaller amount of nitrate so exported, their gross receipts were only $15,000 less than the previous year. The working expenses had been reduced $6827; but maintenance of works had increased to a slight amount. The Manager's presence was required in England, so that some method could be devised to prevent the serious thefts of water which were constantly going on. The decrease of £1075 in the London expenses was due to the debentures having all been paid off. The total quantity of water sold during the year was 92 million gallons, and their works had a capacity of 152 millions. He moved the adoption of the report and accounts, and the approval of a dividend making 7½ per cent. for the year. The motion was carried unanimously.

PARLIAMENTARY INTELLIGENCE.

GLEANINGS FROM THE COMMITTEE ROOMS.

So scarce was information last week in the Committee Rooms concerning Gas and Water Bills that what did transpire might almost be disregarded, if it were not advisable to preserve a continuity of record. So far as gas matters go, gossip as to what may happen in the future is all that the note book contains this week. It is said that there is a prospect of the Longwood Gas Company having to meet the Huddersfield Corporation again when the Bill of the former comes before the Committee of the second House. We were hoping that the latter had been so abashed by their recent defeat that they would not have turned up in Parliament again on the same errand. But perhaps this was expecting too much. There are bold men in Huddersfield; and so we shall not be surprised if hearsay is correct. Then the local authority and residents of Broadstairs are getting up a very strong opposition to the site proposed in the Gas Company's Bill for their new works—notwithstanding the great wisdom of the Committee of one House who have passed the site on the condition that plant of diminutive stature only be erected during the next few years, and that the works be girdled with a broad belt of trees, of which the height is not stated. Another eminent gas engineer, it is said, has been to Broadstairs inspecting the proposed site and the suggested alternative site; and he will add the weight of his opinion to that of the expert who appeared against the Bill when it was in the first House. There is the promise of an interesting contest here, and the outcome will be awaited with no little excitement by the parties. It is reported that the Chard Corporation have already determined, if they can get the consent of the ratepayers, to take advantage next session of the purchase clause which has been inserted in the Gas Company's Bill.

The Release of Leamington. The Bill of the Leamington Corporation, which contains numerous provisions having for their purpose the better government of the town, came before a Commons Committee on Friday. It only calls for notice here as it contains the clause which is intended to annul the power and engagement of the Corporation to purchase the gas undertaking. This is a novel clause; but it is the one and only way that the Council can release themselves. The story of how for years the Corporation hankered after the possession of the gas-works, of the obtaining of parliamentary powers, of the report of Mr. Thomas Newbigging which brought home to them the conviction that the purchase would not be a provident one, of how to the amusement of many they saw fit to scamper out of the job, and of how they were legally advised that Parliament alone could free them, need only to be mentioned to refresh the memory of readers. The clause is not opposed—in fact, there is no one, excepting the Gas Company interested in it, and they are well content to remain in possession of their property. Thus the Corporation will get the release they seek; and then good-bye to gas-works purchase in Leamington—perhaps for aye.

The Fight for a Park. The note on this subject in last week's "Gleanings" fully explained the nature of the big tussle then in progress before a Commons Committee between Liverpool and Bolton in connection with the Bill of the former. It will be remembered that one section of the Bill proposed the compulsory acquisition of some 6000 acres of the drainage area surrounding the Rivington reservoirs, in order to give the Corporation entire possession of the watershed (10,000 acres in extent), and so ensure for the Rivington water supply full protection. In the area proposed to be acquired is the stretch of land presented to Bolton by Mr. W. H. Lever for use as a park. The site is one of particular attraction for the purpose; and Bolton very naturally do not desire to be dispossessed. The fight continued on Tuesday, Wednesday, and Thursday in the past week; and several more witnesses were called to vindicate the contention of the promoters as to the necessity for precautionary measures being taken to protect the supply, and as to the danger of permitting the congregation of large crowds of people in the vicinity of the reservoirs. Mr. Joseph Parry, the Chief Water Engineer of the Corporation, Dr. Hope, the Medical Officer of Health, Professor Campbell Brown, the City Analyst, Professor Boyce, Dr. Stevenson, Mr. G. F. Deacon, and Mr. James Mansergh were among the witnesses who subscribed to the testimony of the previous week on behalf of this section of the Bill. The result was the only one that could be expected after hearing the evidence, and the one which, as indicated last week, we consider right under the circumstances. It was a complete victory for the promoters; and the variations from the clauses as they originally stood were only of minor importance—such as the substitution of six months for three years as the time within which notice to purchase is to be given.

Expensive Reservoirs at Huddersfield. Difficulties hard and expensive have persistently come in the way of the construction of the Butterley and Blakeley reservoirs of the Huddersfield Corporation. The first-named reservoir was commenced in 1890, but even now it is not completed. When the puddle trench was excavated, owing to the stratification, it was found necessary to go 80 feet, and in some cases 100 feet, lower than was anticipated; and then, when the reservoir was filled, it would not hold water. The considerable leakage which took place was not through the artificial works, but through the natural rocks on both sides of the valley. The estimate for the construction of the reservoir was originally £152,476; and already more than £293,000 has been expended on it. The remedial works are estimated to cost £150,000. It is proposed to make wing trenches, but exactly what will be done, Mr. Charles Hawksley states, can only be determined as work proceeds. Broadly speaking, the same difficulties have been experienced at the Butterley reservoir, but not to the same extent. The original estimate for this reservoir was £38,215; but already £66,000 has been expended on it. It is calculated that the remedial works here will need a further £60,000. Under these hard and really serious circumstances, the Corporation have laid the matter before Parliament in an Omnibus Bill which they are promoting this session; and in it they ask for an extension of time for construction, the necessary money powers, and a modification of the terms of the former Act respecting compensation water. By the time the Bill reached the Commons Committee to which it had been referred, it was unopposed; but it was necessary to deal with objections of Government departments. The Bill engaged the Committee at their sittings last Wednesday and Thursday. The engineering evidence was supplied by Mr. Charles Hawksley; and Mr. Lloyd, the Town Clerk, was examined as to the proposal to capitalize the interest on money expended on the works during the period of construction. He stated that the immediate effect of refusing the application in this regard would be to impose a sixpenny rate on Huddersfield ratepayers alone, no portion of which would fall on the outside authorities supplied with water. Ultimately the Bill was passed; a strong recommendation being made that the Corporation should establish something in the nature of a sinking fund out of the rates, to meet the several payments for which they are proposing to borrow.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bills brought from the Commons, read the first time, and referred to the Examiners: Bedford Corporation Water Bill, Belfast Corporation Bill, Birkenhead Corporation Bill, Bournemouth Gas and Water Bill, Halifax Corporation Bill, Knaresborough Improvement Bill.

Bills presented, read the first time, and referred to the Examiners: Gas Orders Confirmation Bill (No. 2), Gas and Water Orders Confirmation Bills (Nos. 1 and 2), Paisley Gas Provisional Order Confirmation Bill.

Bill read a second time and committed: Leyland and Farington Gas Bill.

Bill reported: Weardale and Shildon District Water Bill.

Bills read the third time and passed: Bradford Corporation Bill, Bradford-on-Avon Gas Bill, Bristol Water Bill, Bromley Gas Bill, Grand Junction Water Bill, Higham Ferrers and Rushden Water Board Bill, North Warwickshire Water Bill, Reading Gas Bill.

HOUSE OF COMMONS.

The following further progress has been made with Bills:—

Bills brought from the Lords, read the first time, and referred to the Examiners: Bradford Corporation Bill, Bradford on-Avon Gas Bill, Buxton Urban District Council Bill.

Lords Bills read a second time and committed: Chigwell, Loughton, and Woodford Gas Bill, Rhondda Urban District Council Bill, Swansea Corporation Water Bill.

Bills reported: Huddersfield Corporation Bill, Street Urban District Council Water Bill [Lords].

Bills read the third time and passed: Bedford Corporation Water Bill, Belfast Corporation Bill, Caterham and District Gas Bill, Halifax Corporation Bill, Knaresborough Improvement Bill.

The Huddersfield Corporation have petitioned against the Longwood Gas Bill.

Heywood Gas Supply.—At the Quarterly Meeting of the Heywood Town Council last Thursday, Alderman Firth, the Chairman of the Gas Committee, reported that there was a loss of £299 for the past financial year. Since their present Manager (Mr. W. Whatmough) was appointed they had received from the Gas Department £6564 in relief of rates; and this was only the third time they had failed to have anything. The minutes showed that the consumption of gas for the year had amounted to 129,806,000 cubic feet; being an increase of 4,013,000 cubic feet over the previous year's total.

Suffocation by Gas.—Last Sunday week, seven members of a family living in the Wandsbecker Chaussee at Hamburg, were overcome by an escape of gas, as they slept. Some workmen who entered the house on Monday morning to do certain repairs found four of the number dead, and the remaining three in a very serious condition, necessitating their removal to hospital the same day. Cissy Stringer, the daughter of one of the coachmen of the London Salvage Corps, was found lying dead in her room. Examination showed that one of the weights of the chandelier had dropped off, and the chandelier had fallen. The gas had consequently been pouring into the room all through the night.

New Joint-Stock Companies.—The Rotary Meter Syndicate, Limited, has been registered with a capital of £5000, in £1 shares, to adopt an agreement made on the 21st ult. between Thomas Thorp and S. E. Worsley, to acquire certain patents relating to improvements in the manufacture of fluid-meters, or apparatus used in the manufacture, distribution, or consumption of gas, water, or electricity. The Household Gas-Stove (Parent) Company, Limited, has been registered with a capital of £50,000, in £1 shares, to acquire a certain invention for improvements in and relating to burners; to adopt an agreement with W. H. Palmer; to exploit, develop, and turn to account the invention or any others connected with gas burners, gas lighting or warming, and otherwise.

Primitiva Gas and Electric Lighting Company of Buenos Ayres, Limited.—According to the report of the Directors of this Company, to be presented to the shareholders at the annual general meeting to-day, the balance of the revenue account amounts to £80,444. After deducting interest (which will not be incurred again), London expenses, remuneration of the local Board, and income-tax, there remains a net profit amounting to £67,305, which, after paying the interest on debentures (£14,533), leaves a sum of £52,772 available for distribution. Two dividends of 2s. 6d. each (free of income-tax) were paid for the past year, on the preference shares of the Company, absorbing £40,000; leaving £12,772, which the Directors propose to carry forward to new account. During the year a sum of £45,191 was expended on capital account on improvements and extensions of mains, cables, &c., and on new electric plant and machinery, which had been rendered necessary in consequence of the increasing demand for electric lighting.

JOINT PARLIAMENTARY COMMITTEE ON THE LONDON WATER BILL.

(*Lord* BALFOUR OF BURLEIGH, *Chairman.*)

Ninth Day—Tuesday, May 6.

On the resumption of the inquiry this morning,

Mr. J. D. FITZGERALD said: I desire to make a short statement on behalf of the Government in reference to the decision which the Committee arrived at on Wednesday last, to alter the constitution of the Water Board by deleting the representation of the sanitary authorities—that is, the Metropolitan Boroughs inside London, and the Urban Authorities outside London. This decision of the Committee has been considered by the Government; and it has been received by them with profound regret. Its consequences are far-reaching; and all that I can do in the way of carrying out the view expressed by the Committee will be to refer them to the scheme for the Water Board proposed in paragraph 147 of the report of Lord Llandaff's Commission. I may briefly state the reasons which prevent the acceptance of that scheme by the Government. The scheme is not in accordance with the general principle on which the Bill is founded; it has not received support in Parliament, although the matter has been fully discussed there; and it does not give any representation to the sanitary authorities, who, in the opinion of the Government, are the bodies most interested, especially from the point of view of the consumers. Further, the body would be too small, and would not provide a sufficient number of members for the numerous Committees required. Then there is this difficulty: The Committee has said that no County Council should have a majority on the Water Board; but London has an enormous preponderance, both in population and rateable value, and therefore, in some shape, ought to have the majority on the Board. If no single authority is to have a majority, then London can only have its fair share of the representation by giving representation to its municipal bodies. Again, a somewhat similar body was proposed by Lord James's Bill; but the proposal was not found to be acceptable, either to the outside authorities or to the London County Council. On the other hand, the proposal that the sanitary authorities should be represented has received considerable support, and the scheme of the Bill has found a very general acceptance. Now, when this discussion took place last Wednesday, before any decision was given, there is a matter I desire to call the attention of the Committee to. After the adjournment, Mr. Blennerhassett, who represents the City of Westminster, intervened, and said: "Since I have been out of the room, I am told your Lordship has ruled that the question of the rights of the Borough Councils to be represented on the Water Board is a question upon which you will receive evidence from the London County Council." [My friend had been misinformed. No such ruling had been given.] "On that point, I ask your Lordship, before you come to any decision, to allow me to give evidence on behalf of the Borough of Westminster. We were under the impression that, the question being one of principle, your Lordship would not treat it as an open question, and would not receive evidence upon it; but if your Lordship so rules, we ask you, before you come to any decision, that we should have the opportunity of placing our views before you." Then your Lordship said: "I do not think we have actually made the ruling you indicate; but I will take a note of your expression of wish to give evidence on that point, and, if necessary, you shall have the opportunity of doing it." Then I said: "There are a number of other Metropolitan Boroughs who did not petition against the Bill because they were satisfied with the representation given to them, and because they wished to be representative; and if the question is to be raised, and their representation is to be taken away and transferred to the London County Council, we desire to put some witnesses before the Committee to say that they wish to be represented directly themselves." Then your Lordship said: "My desire always is never to decide a thing before it is absolutely necessary. Again I say I will take a note of that, and find out exactly what the issue that the London County Council is going to put before us really is." Now that certainly left me under the impression that no decision adverse to the representation of the Metropolitan Boroughs would be arrived at by the Committee without giving those Boroughs an opportunity of being heard. The claim of Mr. Balfour Browne, to whose remarks I mainly addressed myself, was that the London County Council should have a preponderating voice on the new Board. In view of what has happened, I ask the Committee to reconsider the decision which they arrived at on Wednesday last, and to allow the representatives of the Metropolitan Boroughs to be heard. There are a number of them here who would desire to place their views before the Committee, so that, before an ultimate decision is arrived at, the whole matter may be fully before the Committee, including the evidence of the representatives of those Metropolitan Boroughs who are the parties deeply interested in the ultimate decision.

Mr. BLENNERHASSETT (for the City of Westminster) strongly supported the application. His Council had received the decision of the Committee with profound regret, and with the utmost surprise, as had the other Metropolitan Boroughs. They had certainly been under the impression that the question of their representation was one of principle decided on the second reading of the Bill, and not open to the Committee to reconsider. The Metropolitan Boroughs were more closely in touch with water consumers than was the London County Council.

After deliberating in private for about half-an-hour,

The CHAIRMAN announced the decision as follows: The Committee have resolved to receive the evidence on behalf of the Metropolitan Boroughs and the urban districts outside the Metropolis, if they think fit to tender it, as to the constitution of the Board.

Mr. FITZGERALD said that many Urban Councils and Metropolitan Boroughs had not petitioned because they were satisfied with the Bill. He would therefore call representatives of those bodies.

Mr. *W. J. Crump* (Mayor of Islington), examined by Mr. FITZGERALD, said the borough was the largest in London in point of population, having 340,000 inhabitants. Its rateable value was £1,900,000.

Mr. FITZGERALD: When you heard the Government were about to introduce a Bill creating a Water Board, was the matter discussed at a meeting of the Metropolitan Mayors?

Witness: Yes; and a resolution was almost unanimously carried requesting that a representation be made by the Metropolitan Borough Councils to the President of the Local Government Board that those Councils, as health authorities, should be represented on the Water Board.

What was the feeling of your Council as to the representation given by the Bill to the London County Council?—The feeling was that they had very little to do with this matter, and that it was really a question for the Borough Councils of London, they being the health authorities; and it was thought that the representation given to the London County Council was too large. But, sooner than jeopardize the Bill, the Council did not make any representation with regard to the matter to Mr. Long.

Is it correct, as was stated by Mr. Balfour Browne, on behalf of the London County Council, that no representations had been made by the Borough Councils asking that they should have representation on the Board?—Absolutely incorrect. From the time we heard that the Government intended to introduce a Water Board, the Metropolitan Borough Councils have all of them been most anxious that they should be represented on the Water Board.

From your experience, what do you say as to the Borough Councils being the proper authorities on the Water Board?—I consider that the *personnel* of the Borough Councils of London, taking Islington as a sample, is quite equal to that of the London County Council from the business point of view. The members are in more direct touch with the ratepayers and water consumers than the representatives of the County Council. All the aldermen and councillors live in the borough; whereas out of the eight representatives of the County Council, only two do so. At the County Council election, 50 per cent. of the electorate voted; while 55 per cent. voted for the Borough Councils.

In cross-examination by Mr. FREEMAN (for the London County Council), witness said that the sanitary powers of these bodies were practically the same as those of the vestries.

Mr. FREEMAN: Are you aware that your predecessors, the Islington Vestry, presented a memorial to Lord Llandaff's Commission requesting that the County Council should be the authority?

Witness: That may be. They were constituted of different men with different views; not such businesslike men as those on the Borough Council.

Dr. *James White*, Mayor of Lambeth, gave similar evidence as to the desire for representation on the part of that borough. His Council had passed a resolution in favour of the Bill as introduced.

Mr. FREEMAN said he would not repeat his cross-examination of each witness.

Mr. *Barnes*, Mayor of St. Pancras, gave evidence to the same effect as the preceding witnesses.

Colonel *Probyn*, Mayor of Westminster, in answer to Mr. BLENNERHASSETT, said he was also a member of the School Board and of the London County Council (Strand district). The Bill had been considered by the Law and Parliamentary Committee of the Westminster Council, and a petition presented in favour of it.

Mr. BLENNERHASSETT: You took the chair yesterday at a meeting of Metropolitan Mayors held to consider this question. What was their opinion?

Witness: We were 19 altogether, and 18 voted in favour of the Metropolitan Borough Councils being represented on the Water Board and one against. At my request, that one was good enough not to vote against, but to remain passive; and, accordingly, we passed the resolution *nem. con.* I have all along looked upon the representation of the Metropolitan Borough Councils as the principle of the Bill, and never contemplated that that would be altered by the Committee. I wished to put forward the claims of all Metropolitan boroughs; but particularly that of Westminster, on account of its size and wealth.

Mr. FREEMAN (in cross examination): You have been a member of the County Council since its formation, and are thoroughly well acquainted with what has taken place there with regard to the water question?

Witness: Yes.

You have been in favour of its purchase by the London County Council?—Yes; if I could get no other authority to do it.

Have you ever suggested on the Council that there should be representation of such bodies as the Borough Councils?—I cannot say that I have.

May I take it that no representation was ever made by your Council until you found their name in the Bill? Did it ever occur to them before that they should be part of the water purchasing and managing authority?—Oh, yes; I think we distinctly wished it. We had a meeting of Mayors, when a resolution of that kind was carried.

Mr. *Bain*, Mayor of Woolwich, said that the Borough Council of Greenwich desired to be represented on the Water Board.

Mr. *T. W. Williams*, Mayor of Lewisham, made the same statement on behalf of that borough.

Mr. *Wilson*, Clerk to the Urban District Council of East Ham, examined by Mr. LANKESTER, said theirs was the most increasing district in the whole kingdom. It had a population of 10,000 in 1881, 35,000 in 1891, and over 96,000 in 1901. It was about 100,000 now; and was increasing at the rate of 4000 or 5000 a year. His body were the sanitary authority for the area, and as such were very much interested in the supply of water. The Essex County Council did not really represent the district—being composed of members representing the rural district; and his Council did not consider that the rights of those connected with urban matters were at all properly looked after.

Mr. W. H. DICKENSON said he had been instructed that the question of the representation of Tottenham should be placed before the Committee if any other course were decided upon than that already stated by them—viz., that the County Council should represent the public. If the Urban District Councils were to be represented on the Trust, he asked that Tottenham should be included in the Bill, and that its proportionate representation should be considered. The same point would arise with regard to Cheshunt and Enfield.

On Mr. WEDDERBURN rising to address the Committee on behalf of the Kent Authorities,

The CHAIRMAN said the Committee had decided that the whole case should be taken on the question of separation.

Mr. FITZGERALD said before the Bill was introduced, requests for representation had been received from Marylebone, Hammersmith, Islington, Woolwich, Stoke Newington, St. Pancras, and Greenwich; their total population being 1,080,000. Subsequently to the introduction of the Bill, similar communications and petitions were received from Paddington, Kensington, Stepney, Wandsworth, Lewisham, Hackney, and one other—making altogether 14 Metropolitan Boroughs, with a total population of 2,337,000.

Mr. FREEMAN said he was instructed that the alleged unanimity of the boroughs in asking for representation was a great mistake, and that there was a schism of opinion; and he would like to deal with that by evidence. The London County Council did not know that the matter was to be re-opened in the way it had been, and therefore the evidence could not be called that day.

The CHAIRMAN said that the Committee would give Mr. Freeman every reasonable opportunity he could ask for. They would hear his evidence before deciding further on that part of the case.

In reply to applications to be heard on behalf of the Urban District Councils,

The CHAIRMAN said the Committee would give till the next morning for any urban district to call evidence. It was clear that any such evidence ought to be given before the substantive evidence on behalf of the County Council in the contrary direction. He assumed the case of the Metropolitan Boroughs was concluded, so far as evidence was concerned.

Lord ROBERT CECIL then addressed the Committee on behalf of Hertfordshire and the City of London. He said that the County Council of Hertfordshire would prefer the Board as originally constituted under the Bill. They thought the proposal of the London County Council was one of considerable danger, and would be very prejudicial to the interests of Hertfordshire, in case, through any change in the water area by Middlesex or Kent being constituted separate water authorities (of which they now entertained hopes), a majority on the Board was obtained by one County Council. The City of London wished in every way to support the Metropolitan Boroughs; their view being that those who had the charge of the sanitary interests of the Metropolis should manage directly its water supply.

Mr. BELLEWES asked the Committee, in the event of their deciding to reconsider the constitution of the Water Board, to take into account the arguments brought forward for increased representation by the city of Westminster.

Mr. RIGG, on behalf of the County Council of Wiltshire, said that the Bill proposed to enable the Water Board to purchase and exchange and get land anywhere it could. Owing to the present state of the law with regard to underground water, wherever the Board could buy land it could sink wells and pump water. This would largely affect Wiltshire.

Mr. FITZGERALD said an amendment was proposed to that clause, and it had better not be discussed by Mr. Rigg until he had seen it.

Mr. RIGG said that if the amendment made the Board unable to purchase land in Wiltshire without going to Parliament, or prevented the Board from sinking wells on any land, that would satisfy this part of his contention. But he had another point—viz., that, if it were proposed to re-constitute the Board, Wiltshire had an equal claim with Berkshire to be represented.

The CHAIRMAN: If we add any other County Councils who are not already named in the schedule of the Bill, Wiltshire shall have an opportunity of being heard.

The further consideration of the constitution of the Board was then postponed till next day, in order that evidence for the Urban District Councils and the London County Council might be heard.

Mr. WEDDERBURN, on behalf of the Kent County Council and other Kent Authorities, then urged the insertion of a clause in the Bill separating Kent from the proposed Water Board, and giving them a separate Water Board of their own. He said it was unquestionable that if the areas he represented did not border upon the county of London, they could, in accordance with principles which had actuated Parliament for many years, possess themselves of the water undertaking within their district; and the question was whether their connection with London was really sufficient to deny to them that which would otherwise be their undoubted right. In this respect, the burden of proof lay with the Government. As far as he knew, there was no precedent for handing over the water undertaking of a district, against the wishes of its consumers, to a body which did not represent them. No doubt the report of Lord Llandaff's Commission was against general severance; but the case of the Kent areas was a single and exceptional one, and was not dealt with by that report. All the sources of supply were within their own area; and they wished to avoid depletion of their streams. He asked for a separate Water Board, and to call evidence in support of that course, because Kent really had a right to claim exceptional treatment. Their interests were so divergent from those of the other representatives on the Board, that increased representation, to be adequate, was impossible; and therefore the only thing was severance. If the clause were rejected, the Kent Authorities would not ask for increased representation.

Mr. FITZGERALD urged that the question was one to be raised on a Bill promoted by Kent after the Trust had been formed, although he did not suggest that such a proposition would be entertained by Parliament.

Mr. WEDDERBURN asked, if the clause were rejected, that the Committee should make it clear that that decision should not prejudice Kent in coming and asking Parliament to give them their water supply.

The Committee-room was again cleared. On the public being re-admitted,

The CHAIRMAN said: The Committee have resolved that they cannot entertain this clause; but, at the same time, they desire that this decision should not prejudice future applications to Parliament.

Mr. WEDDERBURN asked if he might be allowed to bring up words embodying that decision.

The CHAIRMAN said this might be done; but, in the meantime, Mr. Wedderburn should try to agree to a form of words with the Local Government Board.

Mr. WEDDERBURN said the decision given by the Committee was of great value to the Kent Authorities, and should be in the Bill.

The CHAIRMAN: Quite so; and it is possible that, at a future stage, the Committee may be able to give a fuller expression to what they mean. But it is better not to do so just now.

Tenth Day—Wednesday, May 7.

On the resumption of the inquiry to-day,

Mr. FITZGERALD stated that the Mayors of several Metropolitan Boroughs who were not able to be present on the previous day desired to give evidence.

Sir *John Aird*, Bart., M.P., Mayor of Paddington, was then called and examined by Mr. FITZGERALD. He said the matter of representation had been brought before the Borough Council, and they had applied to the Local Government Board to introduce the clause in question giving representation to the Metropolitan Boroughs. Afterwards an intimation had been given to the Council that the matter had been arranged.

Mr. FITZGERALD: Is it your view that that representation should be retained in the Bill?

Witness: I think, for the sake of Paddington, it is most important. It is most essential to have on the Water Board a member representing the district who is conversant with it and with the circumstances of the neighbourhood. I do not think that would be the case with representatives coming from the London County Council, who are not conversant with the circumstances of the water supply.

In cross examination by Mr. BALFOUR BROWNE, witness said the matter had not been before the Borough Council since the occasion of which he had spoken; and he was not aware that any resolution was passed by them.

Mr. BALFOUR BROWNE: Do you know what the sanitary duties of a London Borough are?

Witness: I have been connected with them all my life, and have taken a very active part in them for the last thirty years.

Do you know that they have no duties such as Urban District Councils have with regard to water supply?—That is a matter rather outside the borough of Paddington.

Do you know that, even where they have sanitary duties, there is a power of supervision vested in the London County Council?—That also is not a matter which appertains to Paddington. I would rather not say.

Mr. *Walter Johnson*, Mayor of Hackney, in answer to Mr. RAM, said his Council approved of the Bill, and of the representation proposed.

In cross-examination by Mr. BALFOUR BROWNE, witness admitted that a public meeting of the ratepayers had been convened by the London County Council, when the following resolution had been passed: "That this meeting strongly protests against the proposal to hand over the vast interests of London in its water supply to an irresponsible authority on the discredited model of the Metropolitan Board of Works, and requests the Mayor to forward this resolution to the Marquis of Salisbury, the Right Hon. Walter Long, M.P., and the Chairman of the London County Council." He sent that resolution, but added in his covering letter: "The Borough Council are in no way responsible for the meeting; but, in accordance with the usual practice, I presided in my capacity as Mayor of the Borough." It was a fairly good meeting, and the resolution was carried by a majority of something like three to two.

Mr. *J. J. Runtz*, ex-Mayor of Stoke Newington, also said his Council approved of the Bill, so far as regarded the constitution of the Board. The chief reason why they should be represented on the Board was, to his mind, that the members of the Metropolitan Boroughs were better representatives of the ratepayers than the London County Council, inasmuch as the former resided in the district, and were in close touch with the people.

Mr. *J. Lidiard*, ex-Mayor of Wandsworth, gave similar evidence.

Mr. FITZGERALD said, as far as the Mayors of Metropolitan Boroughs were concerned, he had no more in attendance.

Mr. CRIPPS (Parliamentary Agent for the London County Council) said there would not be a desire to cross-examine any more of these witnesses.

Mr. FITZGERALD said that witnesses from the Urban District Councils would now be called.

Mr. *Horace Nelson*, Chairman of the Hampton Wick Council, Mr. *Cohen*, Clerk to the Walthamstow Council, Mr. *Culne*, Chairman of the Council of Esher and the two Dittons, Mr. *Chambers Leete*, Town Clerk of Kensington, and Mr. *W. Hobart*, ex-Chairman of the Twickenham Council, gave similar evidence.

The CHAIRMAN at this stage suggested that, as there had been no cross-examination of these witnesses, the list might be read, and the County Council could then name those whom they wished to be called for purposes of cross-examination.

Mr. FITZGERALD said this would shorten the proceedings. There were other witnesses, however, who would have to be called by some of the petitioners.

Mr. *G. Courthope*, member of the Kent County Council, and Chairman of the Parliamentary Committee of that body, said the desire of the Kent Authorities had been for complete severance; but as the Committee had decided against this, they wished to have the representation which was given them under the Bill.

Mr. *C. E. Baker*, member of the Beckenham Urban District Council, and Chairman of the Parliamentary Committee, corroborated.

Mr. *H. A. Winser*, the Town Clerk of Kingston-upon-Thames, stated that only two members on the Surrey County Council would not be so great a safeguard in local matters as would the representation proposed in the Bill as drawn.

Evidence was given to the same effect on behalf of the Wimbledon and Surbiton Urban District Councils.

Mr. FITZGERALD intimated that other gentlemen were ready to give evidence in favour of Urban Councils being represented on the Board directly, instead of through the County Councils.

Mr. *A. F. Redman*, Mayor of Southwark, examined by Mr. THESIGER, said the Council of that borough were of opinion that, if the County Council represented London on the Water Board, public control would be better secured than if the members were nominated by the Borough Councils themselves.

In cross-examination by Mr. FITZGERALD, witness said he considered the Water Board should be representative of the ratepayers. Failing that, he preferred the London County Council.

Mr. *T. Davies*, Mayor of Fulham, said his Council wished to be represented through the London County Council rather than by sending a delegate of their own to the new Board. It was his opinion that the district would be better served by such an arrangement.

Several other witnesses gave evidence to the same effect.

Mr. *T. M'Kinnon Wood*, Chairman of the Water Committee of the London County Council, examined by Mr. BALFOUR BROWNE, gave evidence in support of the revision of the scheme proposed in the Bill. He said there was really no ground for the Metropolitan Boroughs being represented on the Water Board. The Council already had the management of the main sewerage and also of the Fire Brigade.

Mr. BALFOUR BROWNE: It has been said that these Metropolitan Boroughs are more directly representative of the people. Is that correct or is it not?

Witness: It is not so at all. My view is that the London County Council is elected by a much larger number of ratepayers than are the Borough Councils.

In further examination, witness said the New River Company was managed by 25 Directors and the Southwark and Vauxhall Company by 10; the directorate of the former undertaking being large because land as well as water had to be dealt with. If these Companies could be managed by the number of Directors stated, the London County Council would be sufficiently able to carry out the duties under the Water Board. Since the creation of the Council, it had been recognized that they were the representatives of the interests of the ratepayers and water consumers. The boroughs had never attempted to perform that duty. If they took the water supply from the Council, they might as well do the same with the main drainage and fire extinction. The constitution of the Water Board suggested in the Bill was not on the basis which the Council desired; and they considered that the water supply should be in the hands of the Council.

In cross-examination by Mr. RAM, witness said he looked upon it as only sound policy that the Council should have the preponderating influence on the proposed Water Board.

Mr. BALFOUR BROWNE then addressed the Committee in support of their decision. He said the additional evidence adduced had shown that the Metropolitan Boroughs, or a great number of them, did not require the representation on the Board which was proposed to be given to them. He did not know what the position of the Committee was, but, at all events, he hoped they would not go back upon their decision. On the second reading of the Bill, the House came to the conclusion that the London County Council were not to be the sole authority, and the Bill was sent to the Committee to consider the whole case. They had done so, and had decided what should be the number of members of the Water Board. The County Council had the greatest confidence in the Committee and in their decision; and he did not think it could be set aside. He looked upon the Committee as largely one of experts.

Mr. RAM briefly replied; urging the Committee to come to the conclusion that the Metropolitan Boroughs and Urban District Councils should have representatives on the Board.

The room was then cleared to allow the Committee to deliberate. On the re-admission of the public,

The CHAIRMAN intimated that, as the matter was one of so much importance, they desired further time to discuss it. They would therefore adjourn until one o'clock on Monday (yesterday), when they would meet to further consider the question, and give their decision.

The Committee reassembled at one o'clock yesterday, and had a long deliberation in private. On the public being admitted, the Chairman said: Adherence to the resolution come to on the 30th of April was lost on an equality of votes on division in the Committee: The precise form of Schedule III. will therefore remain for decision when the Committee have reached that point in the Bill, after going through clauses. Those who understand the working of the rules of the House of Lords which govern the Committee will understand that in case of equality of votes the form of the Bill stands.

Ironmongers and the Gas-Stove Trade.—At the annual conference of the Ironmongers' Federated Association last Thursday, Mr. J. H. Dunn (London) introduced a discussion on the gas-stove trade, and suggested that the attention of gas companies should be called to the fact that, by selling stoves at cost price, they were injuring the ironmongery trade. He advocated a working agreement between the manufacturer, the ironmonger, and the gas company. Mr. J. R. Wilson cited the case of Manchester, where, he said, the Corporation had taken up the hire and sale of stoves at a profit of 10 per cent., and fixed them free. He maintained that no ironmonger could afford to sell stoves at this profit and fix them free. Eventually a resolution was passed to the effect that the General Secretary should communicate with the local associations in whose districts no working arrangement with the gas companies existed, asking them to try to make one under which an allowance would be made to the ironmongers, in accordance with size, upon every stove fixed.

Teignmouth Water Supply.—The question of the water supply was again under the consideration of the Teignmouth District Council last Tuesday. Mr. T. Matthews, of Manchester, had visited the district at the request of the Council; and he was of opinion that the supply required—viz., 300,000 gallons per day—could be obtained from the new red sandstone. He recommended the placing of a pump 200 feet down the borehole at the well as a means of increasing the supply. A number of ratepayers petitioned in favour of this plan, and several members of the Council strongly urged that it should be carried out as a means of immediately augmenting the present supply. On the other hand, objection was taken that the Council had no money with which to pay for the hire of a pump; that the Surveyor had not been consulted as to the proposal; and that pumping now might exhaust the well, and leave the town without water in the summer. In the end, it was decided, by the casting vote of the Chairman, to defer further consideration of the scheme until the Surveyor had been consulted.

LEGAL INTELLIGENCE.

WESTMINSTER COUNTY COURT.—Thursday, May 8.

(*Before His Honour Judge* WOODFALL.)

Edwards v. Gaslight and Coke Company—Claim for Compensation for Injuries.

This action, which was brought by a workman to recover damages for injuries sustained in the course of his employment, was originally commenced under the Employers' Liability Act, and was tried on the 25th ult., when the Jury returned a verdict for the defendants. An application was then made to give the workman compensation under the Workmen's Compensation Act. The point was, however, reserved for further consideration, and it came on this morning.

Mr. E. BROWNE appeared for the plaintiff; Mr. VAUGHAN WILLIAMS (instructed by Messrs. Bedford, Monier-Williams, and Robinson) represented the defendants.

Mr. BROWNE said he had hoped that some agreement would have been come to to compensate the plaintiff under the Workmen's Compensation Act; and he submitted that as the workman was earning, on an average, £2 a week, and had been laid up for five weeks, £8 was the sum he was entitled to under the Act.

Mr. VAUGHAN WILLIAMS acknowledged that the Company were liable to pay compensation under the Act named; but they submitted that, as the plaintiff had only been in the employ of the Company as a casual labourer, he was entitled to only three weekly payments of 4s. 5½d. each. He was only laid up for five weeks, and therefore became entitled only to half the earnings for three weeks.

His HONOUR asked for proof to be given of the terms on which the applicant was engaged.

The plaintiff not being present,

Mr. *T. S. Lacey*, the Company's Engineer at the St. Pancras station, was called, and said that two classes of workmen were employed—the permanent hands, who were entitled, under agreement, to a month's notice; and the casual hands, who were engaged from day to day, and were not entitled to any notice. At the time the accident happened, five men, including the plaintiff, were engaged upon certain work, and they handled about 263 tons, which was paid for at the rate of 2d. a ton, and yielded for each man 8s. 9¼d. a day.

In cross-examination, witness was unable to say that the applicant had been previously engaged at the gas-works for a period of 16 years, as he had not been there so long himself; but he knew Edwards was employed for a few months in 1895 and 1896, and for a few days in 1897. Since then, however, he had been very seldom at work, and then only as a casual hand. He could not say whether the man whose place he took on the days he was at work was a permanent or a casual man, as sufficient of the latter class of men were engaged every day to meet the requirements of the work arising from the absence or illness of any of the regular workmen.

Mr. BROWNE contended that the man, having worked for the Company, off and on, for a period of 16 years, must be regarded as, to all intents and purposes, a regular workmen entitled to half his annual average wages.

His HONOUR thought the case was covered by the recent decision of the Court of Appeal in *Bartlett v. Sutton and Sons* (1 K.B. 72), which was the judgment of the present Master of the Rolls and Lords Justices Stirling and Mathew. He was bound to find that there was no evidence of antecedent employment of the plaintiff by the same employer within the meaning of the Act, although he had worked at casual jobs, off and on, since he ceased to be a regular workman. He could only regard him as a casual hand, and award him 15s. 6d. He was bound to say the plaintiff was ill-advised in bringing his action under the Employers' Liability Act, on which the Jury very properly found a verdict for the defendants. The Company had at one time offered to give him £5, which he refused; and it was unfair to put the Company to the expense of defending the present action. He therefore ordered that the 15s. 6d., and such costs as the applicant was entitled to under the Workmen's Compensation Act, should be set off against the costs he had to pay defendants in the previous action. Gas companies had no right to be charitable at the expense of their shareholders.

Robbing a Gas Company.

At the Thames Police Court, last Wednesday, a youth named Albert Lambert was charged with stealing two gas-burner elbows, the property of the Commercial Gas Company. Mr. G. H. Young, who prosecuted, said the prisoner was charged with stealing the gas-elbows and also 3d. from an automatic gas-meter at 67A, High Street, Bromley. The house in question was empty at the present time; and last Saturday week William Jones, in the employment of the owner, on going there saw the prisoner, who had gained admission by climbing through an upper window. In reply to a question, Lambert said he came there to have a sleep, as he had nowhere else to go. The prisoner then made off; but later, when a fitter in the service of the Gas Company examined the fittings, he found the gas-meter had been broken open and two burner-elbows taken away. The money-box had also been forced and 3d. taken. A man named Frederick Greig met the prisoner near the premises on Saturday night; and he gave him the gas-elbows to mind. Although, said Mr. Young, the matter at first sight might appear trivial, yet it was not so, for during the present year no less than thirty premises had been broken into and money stolen from automatic meters. However, what was still more serious than the damage, was the danger of an explosion through the escape of gas. Prisoner, in answer to the charge, said he broke the lock of the money-box, but could not get at the coins. Greig was with him at the time, and had some gas-tubing. The Magistrate observed that it was a very serious offence with which the prisoner was charged, on account of the damage and risk of an explosion. He was reluctant to send the accused to prison; but if he was again charged with a similar offence, he would certainly be sent there. He was bound over to come up for judgment if called upon.

MISCELLANEOUS NEWS.

IMPERIAL CONTINENTAL GAS ASSOCIATION.

The Half-yearly Ordinary General Meeting of the Association was held last Tuesday, at the City Terminus Hotel, Cannon Street, E.C.—Mr. T. H. Goodwin Newton in the chair.

The Secretary (Mr. Robert W. Wilson) read the notice convening the meeting, and also the following report of the Directors:—

The present half-yearly ordinary general meeting of the proprietors has been convened in conformity with the Association's Acts of Parliament, for the purpose of receiving a report from the Directors upon the affairs of the Company, and of declaring a dividend for the half year ended Dec. 31 last.

The following summary shows the results of the Association's operations during that period: The quantity of gas made was 4071 million cubic feet; the quantity made in the corresponding half year was 3869 million cubic feet—an increase of 202 millions, or at the rate of 5·22 per cent. The total number of lights on Dec. 31 last was 2,569,829; at the close of the corresponding half year the number of lights was 2,439,054—an increase of 130,775, or at the rate of 5·36 per cent. The number of consumers on the books at the close of the half year was 226,244—an increase in the twelve months of 16,977, or at the rate of 8·11 per cent. The total mileage of mains in use on Dec. 31 last was 1840; at the end of 1900 it was 1775—an increase of 65 miles.

The increase in the revenue derived from the sale of gas was in proportion to the increase in the quantity of gas sold, and may be considered satisfactory—viz., about 5¼ per cent.

The average cost of the coal used during the period under review was 10d. per ton less than in the corresponding period of last year; but, on the other hand, the value of the coke produced suffered serious diminution—counterbalancing not only the increase in the revenue from gas, but also the benefit of the decrease in the cost of coal. The results of the workings at the stations therefore exhibit a small decrease of profit.

The profit of the half year, as shown by the balance-sheet, has been further adversely affected by the diminished income derived from investments on this side.

The plant and mains at all the stations were maintained in a due state of efficiency.

At Antwerp, the new water-gas plant, which is of a capacity of 1½ million cubic feet per day, or about 25 per cent. of the total daily capacity of the station was put into action with satisfactory results.

The rapid growth of the business at this station, which is in no small measure due to the success that has attended the introduction of prepayment meters, necessitates the provision of more accommodation for fitters' shops, &c.; and the Directors propose utilizing for this purpose the site of their former Esplanade works.

At Berlin, the new works at Mariendorf were put in action in October last, and assisted materially in meeting the increased demand for gas at that station during the winter.

Considerable additions and important improvements have been made to the system of mains, which now measures 478 miles; and, owing to the use of mains from Vienna, a large saving in outlay was effected.

A contract was concluded for fifty years, until 1952, with the commune of Lichtenrade, south of Berlin. Prolongations of contracts for five and ten years respectively were negotiated with the communes of Schmargendorf and Tempelhof, in which the Association has now the monopoly of the gas supply until 1946 and 1958.

At Brussels, the erection of the four-lift gasholder in a steel tank at the Koekelberg works was proceeded with. Additions to the producing power of this works are in progress.

The supply of gas by the Association in the commune of St. Gilles was discontinued on Sept. 1. The commune has erected gas-works of its own, and has acquired from the Association, by purchase, on equitable terms, all the mains, meters, services, stoves, &c., in use within its district.

The Directors have concluded a contract for 23 years, until September, 1924, with the commune of Droogenbosch, lying to the south of the Forest works.

At Frankfort-on-Main, the recent addition of seven settings of inclined retorts with a mechanical coke-conveyor was made use of in meeting the demands of the past winter.

At Haarlem, where the Association's concession expires at the end of this year, the Directors concluded an agreement with the town authorities, by which the latter acquire all mains, meters, services, &c., on fair conditions.

At Prague—the most recent addition to the Association's stations—the necessity for additional storage capacity made itself felt, and a new gasholder and tank have been put in hand.

At Vienna, the sale of gas in the suburbs and also in Floridsdorf, and its environs on the other side of the Danube, shows a satisfactory increase.

Land for which there was no further use was disposed of on favourable terms at Toulouse and Vienna.

The Directors also succeeded in disposing of their premises in the Burgring at Vienna, which served the purposes of central offices. Arrangements have been made to accommodate the staff in the Association's premises in the Schenkenstrasse.

The Directors desire, in conclusion, to draw the attention of the proprietors to the accounts for the half year ended Dec. 31 last. These have been duly audited; and from them the Directors have, in accordance with the provisions of the Companies' Clauses Consolidation Act, prepared a scheme showing the profit of the Association for the half year applicable to the purposes of dividend. This profit, the proprietors will observe, was insufficient to provide a dividend of 5 per cent. for the half year; and the Directors propose to make good the deficiency by having recourse to the dividend equalization account, which they established in 1898, to provide for an emergency of this kind; and they accordingly now recommend the declaration of a dividend of 5 per cent. for the half year ended Dec 31 last, payable, free of income-tax, on and after Tuesday, the 13th inst.

The Directors who go out of office by rotation are: Clarence Pigou, Esq., the Hon. Sir E. Chandos Leigh, K.C.B., K.C., and John Horsley Palmer, Esq. These gentlemen are eligible for re-election, and offer themselves accordingly. The Auditor who goes out of office by rotation is Montagu Somes Pilcher, Esq., who is eligible for re-election, and offers himself accordingly.

The Chairman expressed the regret of Mr. Arthur Lucas and Sir James Carmichael at their enforced absence from the meeting. He proceeded at once to deal with the last paragraph of the report, and the last line of the scheme appended to it, which announced that the Directors had been unable to make this half year quite sufficient profit to pay the usual 5 per cent. dividend. This was a circumstance of no real moment, though unprecedented in a long experience of the Association. It arose from a fortuitous combination of circumstances both at home and abroad. Some had been foreseen, and had been referred to on previous occasions. Some were unforeseen—such as the extraordinary weather at the latter part of the period under review. But in whatever way they had contributed to this result, all had been provided for by the foresight of the Board, with the concurrence of the proprietors, in forming the dividend equalization fund. The proprietors would remember that he had pointed out more than once that the effect of forcing up the price of coal (which, among other results, had led to the imposition of the tax on coal) would not be felt by them so much at the time as it would be when they would be using gas coal bought at high prices; the coke resulting from its carbonization being sold in competition with ordinary fuel at ordinary prices—leaving the net price of coal high. It had been forecasted that this state of things would occur in the half year under review; and the effect had been intensified by the very mild weather checking sales of coke. Writing under date of the 4th of March last, Mr. William Drory, their Engineer at Frankfort, reporting his difficulties in finding a market for his production of coke, said: "We have had no winter—only one day when the thermometer fell to 23° Fahr., and now it is as warm as in summer." It would be observed that Mr. Drory was writing on the 4th of March—that is, when two months of the current half year had expired. This showed that the causes which produced bad coke sales in the half year under review continued in the present half year. He called attention to this, as the Board were ever anxious to give the proprietors the latest information at their command. It meant that their coke sales, which were primarily the cause of the trouble, and which amounted to a shortage of over £51,000 for the last half year, were likely to be short again in the present half year. So far, he had dealt with the causes abroad which had contributed to this accidental result; and now he would briefly mention those at home. In the past three years, as he had already fully explained, no less than 1¼ millions sterling, derived from investments at home, had gone abroad to pay for extensions, which at present yielded little; while the money in its previous state of investment had produced a small certain income. The loss under this head in the half year was no less than £13,500. Again, the proprietors would not forget the increased and increasing income-tax at home. On this head, the Association paid no less than £30,000 for the year ending April, 1902. It was quite enough that they should pay abroad to municipalities and in Government and in town taxes as much as £106,000 per annum, without paying anything of the same nature at home on the profits made abroad. The proprietors would remember as he had alluded to already that, to provide for such accidents as had affected the profits for the past half year, they formed, four years ago, a dividend equalization account. The amount of this fund was nearly equal to a dividend of 10 per cent. on the capital stock of the Association. The call upon it, for the first time this half year, was less than ½ per cent. on the capital stock; so that it was strong enough to bear such a loss, even if it recurred for a number of half years. Notwithstanding such slight set-back in the profits of the half year, he felt justified in again congratulating the proprietors upon the general condition of the Association's business. The results of the half year, both as regards the increase in the volume of gas made and sold, and in the number of consumers, were certainly satisfactory. As a convincing proof of the efficiency of their plant, and the tightness of their mains, he might mention that they produced an average of 10,538 cubic feet of gas per ton of coal carbonized; and sold no less than an average of 9888 cubic feet of gas per ton of coal. Thus the percentage of gas not paid for, including that used on the works, was only 6 per cent. The reports from time to time stated the recent increases of consumption at rates varying from 5 to 10 per cent. per annum; and it might be well to consider what these additions had aggregated since the period when they had not lost either Amsterdam or the inner districts of Vienna. Amsterdam was lost in August, 1898, and the inner districts of Vienna in October, 1899; so that, in the year 1897, they had not lost one or the other. The output in that year was 9580 million cubic feet of gas; and the combined loss of these two stations amounted to 3658 million cubic feet, or 38 per cent. of the output of the year ending December, 1897. The output for last year amounted to 7997 million cubic feet, or 83½ per cent. of the output for the year ending on Dec. 31, 1897. The remaining paragraphs of the report called for little comment. They indicated that, at nearly all the stations, works were in progress to meet their growing business, and that, wherever possible—particularly by the conclusion of contracts in outlying suburbs—new sources of supply were found. Since the close of the half year under review, the Association had secured a 20 years' prolongation of their contract with the town of Schöneberg, adjoining Berlin. The terms of this contract, however, were very onerous, as, indeed, the Board found most contracts now were. The authorities of the town who conducted the negotiations deserved well of their constituents in this instance; but he did not think they would have succeeded in making so good a bargain (one term of which was a heavy contribution to the town's funds), if the political horizon had not been so darkly obscured. The Directors had from time to time reported the acquisition of an electric lighting undertaking, or the investment of the capital of the Association in such undertakings, so that they might be able to control, or influence the control. The Board did not look upon electricity as a rival to gas; and they gave this department of their business equal attention. The Association (whose interests at Berlin were identical with those of the Allgemeine Elektricitäts Gesellschaft) had taken up more capital in the Berlin Suburban Electricity Supply Company; and they hoped that, in a short time, this Company would be a dividend-paying concern. He was pleased to say the Lille Electric Lighting Company (the Association's interests in which were well looked after by Sir Charles Jessel, who was a member of the Board of that Company), had, under the able direction of Mr. Delebecque, the Engineer of the Association at Lille, made good progress, and now yielded a moderate return upon the investment. The Ixelles Electric Lighting Company, the whole of the shares of which were the property of the Association, was improving its results; and Sir James Carmichael, its President, had hopes that it would soon be in a position to hand over dividends.

Their electric lighting stations generally were widely scattered; and the Association's Electrical Engineer (Mr. Melhuish) rendered good service in superintending their erection and equipment, and the maintenance of their efficiency. He (the Chairman) mentioned at the last meeting that the Association were likely to secure a remission of the coal tax on the 1901 contracts made in this country. They had since been refunded the money so paid. Their contracts with the Durham collieries this year had been made at a rather lower price than last year; but they would this time have to pay the export duty. The actual gross cost of the coal would be about 8d. per ton higher; and thus they saved 4d. out of the 1s. per ton tax. During the recent excitement prevalent in Belgium over the franchise question, and particularly in Brussels, their Engineer there (Mr. Salomons) took efficient measures with the authorities for the protection of the works and property of the Association from outside attack. It was a matter of common remark, and supported by their long experience, that Light and Authority were always to be found hand in hand. Within, their workmen were true to their duty; and their conduct had given great satisfaction to the Board. The work of clearing away the buildings on the sites of the disused gas-works at Vienna was in progress; and, as soon as completed, the Board would take energetic steps to realize the large area of valuable land for disposal. He regretted to inform the proprietors of the recent death of their representative at Amsterdam (Mr. Bergsma). He rendered good service to the Association during the time when the Association carried on business in that city, and afterwards in settling the many questions affecting the employees, &c. The Board deplored his loss. With these remarks, he would move "That the report of the Directors on the affairs of the Association, which has been read, be received and adopted, and entered upon the minutes."

The DEPUTY-CHAIRMAN (Mr. J. Horsley Palmer) seconded the motion.

Mr. J. SNOWDEN: We want to know what is the amount of the dividend equalization fund.

The CHAIRMAN: The amount is £369,353; and of that only some £17,000 odd is required to make up the dividend.

Mr. GORDON: We have a reserve apart from the fund for the equalization of dividends. What does that amount to?

The CHAIRMAN: £400,000 of 2¾ per cent. Consols.

The motion was carried unanimously.

The CHAIRMAN next moved that a dividend of 5 per cent. for the half year ending Dec. 31 last be declared upon the £3,800,000 stock of the Association, and that the same be payable, free of income-tax, on and after the 13th of May. He added that he hoped everybody understood that it was merely a small fraction of the dividend that was to be taken from the dividend equalization fund, and that this account would stand such calls upon it for years to come.

The DEPUTY-CHAIRMAN, in seconding the motion, said he was sorry the Chairman had not laid stress upon the advantage the proprietors received from having their dividends paid free of income-tax, as it was now 1s. 3d. in the pound. He hoped they would duly appreciate this.

The CHAIRMAN said he should like to add that it would be a great help to the office if the proprietors would order their dividends to be paid through their bankers, in cases where this was not already done. He intended that a note should be sent round to the proprietors on this occasion, requesting them to adopt that plan.

The motion was also unanimously agreed to.

Resolutions were then passed re-electing the retiring Directors (Mr. J. Horsley Palmer, the Hon. Sir E. Chandos Leigh, K.C.B., K.C., and Mr. Clarence Pigou) and Auditor (Mr. Montagu S. Pilcher).

The CHAIRMAN, in moving a vote of thanks to the officers and staff of the Association at home and abroad, said he did not think a gas company at home knew anything by its experience of the value of a staff of a gas company as they (the Directors) saw it abroad. He was very sorry to say that they had one eminent member of their staff from the Continent lying at his London hotel unwell. But he and the staff at large, both at home and abroad, were most assiduous in their attention to their respective duties, and were at the same time most successful in them.

Mr. J. H. BIRCHENOUGH, in seconding the motion, said he might be permitted to say, as the latest elected member of the directorate, that in the visits to the works abroad which it had been his pleasure and duty to pay during the last two years, nothing had struck him so much as the zeal and energy displayed by the staff. With a considerable business experience in this country, and going with a fresh mind to visit the establishments of the Association abroad, he felt that they owed a deep debt of gratitude to their officers, not only for their help, but for the high sense of honour which animated them in their work.

The motion was carried by acclamation.

On the proposition of Mr. R. S. GARDINER, seconded by Mr. M. S. PILCHER, the proprietors expressed their indebtedness to the Chairman and Directors for their exertions on behalf of, and devotion to, the Association.

The CHAIRMAN acknowledged the vote; and this concluded the proceedings.

Water for Gardens at Cardiff.—At a recent meeting of the Water Committee of the Cardiff Corporation, the Town Clerk reported on the use of water for garden purposes; and the Committee recommended that licenses for garden hose-pipes be issued at 10s. per annum in the borough and in Penarth urban district, and at 12s. 6d. in the outside districts, payable in advance.

New Water Reservoir in the Isle of Wight.—Lady Adela Cochrane, the wife of the Deputy-Governor of the Isle of Wight, performed last Tuesday the ceremony of opening a new reservoir, having a storage capacity of 800,000 gallons, at Alvington, Carisbrooke (I.W.). It has been constructed at a good elevation for the purpose of ensuring a sufficient pressure to the higher levels of the town, and for enabling the Newport Corporation to supply the outside districts. There are 3½ miles of trunk mains, varying from 6 to 12 inches in diameter, connected with the source at Idlecombe, enabling a supply to be given to Gurnard and Northwood. The work has been carried out under the supervision of Mr. E. T. Hildred, by Messrs. Stevens and Co.

BUENOS AYRES (NEW) GAS COMPANY, LIMITED.

The Annual General Meeting of this Company was held last Wednesday, at the London Offices, No. 1, East India Avenue, E.C.—Mr. F. J. HESELTINE in the chair.

The SECRETARY (Mr. J. M. Macmorran) having read the notice convening the meeting, the Directors' report and the accounts were taken as read.

The CHAIRMAN said there were doubtless some shareholders present who were interested in industrial enterprises in the River Plate other than this Company; and they would know that the past year was one of exceptional anxiety, owing to the strange relations between Chili and Argentina, and to those depressing influences on trade which follow in the wake of heavy taxation and doubtful crops. As a consequence, disappointment might have been felt by shareholders regarding the effect this condition of affairs produced on some of their investments. If such were the case, they would understand with what pleasure the Directors presented their accounts that day, seeing that, notwithstanding the drawbacks to which he had alluded, the profits of the Company were £10,500 greater than those in 1900; and as a consequence, they recommended the payment of a dividend of 7 per cent. for the year, instead of the usual 6 per cent.—carrying forward the undivided profit of £7369, in place of £2232 as the previous year. But what made this result the more gratifying to the Directors was that it had been obtained, not by any large increase in the sale of gas (for, owing to depression in most branches of trade, this was scarcely to be expected), but in a great measure through the economies in the cost of production which he foretold the shareholders they hoped to effect as soon as certain additions and alterations to the works had been completed, and through the cordial working of their staff. The actual increase in the quantity of gas sold was only about 1¾ million cubic feet. Another matter which contributed to the increase of the profits was the exceptionally favourable year for the sale of residuals. For coke there was an easy market at well sustained prices, owing to a stop being put to its importation; and a larger demand sprang up for tar, which was used for many more purposes than formerly, consequent on the industrial development of the country Minor products, too, were disposed of at more favourable prices. Continuing the policy of maintaining the property in a high state of efficiency, there was expended out of the year's revenue £15,553 on the upkeep of the works and mains. The largest of the gasholders was put out of action at the end of 1900 (this being the Argentine summer); and it had been replaced by an entirely new holder. This commenced working in August, and had given every satisfaction. As might be supposed, very great inconvenience and some loss were experienced during its reconstruction; but, by the intelligent and zealous efforts of the Company's Manager and the staff, all difficulties were most successfully overcome, without having to avail themselves of a kind offer of the River Plate Gas Company. The storage capacity was now considerably in excess of requirements, so that no further expenditure was at present contemplated under this head. Another item of interest was that, although less than £600 was expended in the extension of mains, there was a net gain of 1093 meters fixed during the year. This spoke well for the energy of the distribution department, and of the ample margin there was for an increase of customers on the present system. Turning to the balance-sheet, it would be observed that the debenture stock stood at £250,000; the £30,000 unissued balance, to which reference was made at the last meeting, having been offered to the shareholders, and liberally subscribed for by them To the reserve fund £10,000 had been added, and to the special contingency fund had been placed a further £1974—bringing the two reserves up to £63,295. Of this total, £50,000 was free and available for the equalization of dividends, or any emergency that might occur in the future, and £13,295 was ear-marked for any further depreciation on services and meters when necessary. This led him to call attention to a sum re-transferred, which was shown in the net revenue account as having been set aside out of the revenue of former years for the depreciation of private services and meters. The Manager having shown that, as the provision that had been made for these depreciations was far in excess of what was necessary, the Directors decided to re-transfer the amount, especially as by so doing it did not affect the results of the year's income or profits. In consequence of this over-provision, which had now been rectified, the Directors saw no justification for charging further depreciation against the profits for the year, seeing how large a sum had already been expended on the upkeep of the works; and, as the total cost of both oil and water-gas plant, which might have been charged to capital, had been paid out of the profits of previous years, the shareholders would, he thought, agree with the Board that no charge was necessary. A little explanation might be given regarding the new public lamp redemption fund. By the terms of the new contract with the Municipality for lighting by incandescent lamps, the Company supplied the lamps, receiving so much per lamp per month for light, maintenance, &c. At the termination of the contract, the lamps would become the property of the Municipality. The Directors therefore set aside a proportion of the amounts received monthly, by which they would gradually write off the cost of the lamps; and when the ownership passed from the Company, they would have made all necessary provision for the event. Sundry creditors had been considerably reduced during the year—by more than £10,000; and the item now stood at £25,216. This was not a large amount, considering the business the Company did; and the sum included such items as coal, freight, income-tax, &c., all of which had since been paid. To property account had been placed, for additions and extensions, the comparatively small amount of £5879. This included the cost of a piece of land adjoining the works, which the Company fortunately secured, as it brought their property at Patricios into a compact shape, and gave them room for further works extensions, should they be found necessary. The balance of the £5879 was chiefly for the cost of an extension of the inclined retort house and benches, which was undertaken from motives of economy, seeing that the work could be more cheaply carried out while Messrs. Dempster's men were on the spot. This extension became a valuable reserve for any increase in the

manufacture of gas which might be necessary. The present retorts were, however, far in excess of requirements. The stock of coals, coke, &c., was about the same as last year; and he was pleased to report that the supply of coal and oil for the whole of the present year had been secured at very satisfactory prices, both as regards material and freight, so that the Directors confidently looked for a still further saving in the cost of manufacture during 1902, especially as the sale of gas had considerably increased. The sundry debtors in Buenos Ayres (after writing off bad debts) were higher in consequence of the Municipality falling somewhat in arrear in their payments during the last few months of the year. As a tax was levied by the authorities specially to meet the expenses of public lighting (which tax was estimated to cover the amount due to the Companies who performed this duty), he had every reason to expect that the debt would soon be materially diminished. The amount due from the South Barracas Company had been slightly reduced. That Company's works and plant (which were leased by this Company) were reported to be in good working order. There were, he said, many other matters of considerable interest he would like to refer to did time permit—such as the progress made in the heating and cooking departments, the success that had attended the introduction of incandescent lamps, both public and private, and the great improvements in the carbonizing returns. But the result of the year's work went to prove that these several departments had been actively and intelligently pushed by their Manager and staff. He desired, on behalf of the Board, to acknowledge the services rendered by the Secretary and staff in London and the Local Committee, Manager (Senor Mariano Obarrio), and the other officers and the staff in Buenos Ayres; for it was greatly to their united assistance, energy, and devotion to the Company's interests that the Directors were in a position to-day to render such a satisfactory report of the prospects of the undertaking. He concluded by moving the adoption of the report and accounts, and the declaration of a dividend for the year at the rate of 7 per cent. (free of income-tax), 2½ per cent. of which has already been distributed.

Mr. J. C. IM THURN seconded the motion.

Mr. SAMUEL SPENCER said he thought the balance-sheet must be considered a very satisfactory one. It was certainly the best they had had for many years. The Chairman had mentioned that the increase in the consumption of gas was 1¾ million cubic feet; and he should like to know whether this was an average increase.

The CHAIRMAN replied that it was not; but other companies there had not in the past year made an increase at all.

Mr. SPENCER asked if there was any special reason for that. Was it through the competition of the electric light?

The CHAIRMAN replied that the reason the increase was not larger was not so much due to the electric light as to depression of trade.

After a few further remarks, the motion was unanimously carried.

The retiring Directors (Mr. im Thurn and Mr. Robert Nesham) and the Auditors (Messrs. Turquand, Youngs, and Co.) were re-elected.

The CHAIRMAN said, in speaking of the reserves in his remarks, he had referred to £13,295 having been ear-marked as a special contingency fund for services and meters. He ought to explain that it was ear marked for the present; but later on, if the Directors had the opportunity, they would endeavour to free it. This was really done through a representation by the Auditors.

A SHAREHOLDER said he did not think it was a good thing.

Mr. ROSS PINSENT (a Director): We do not think so either.

An Extraordinary General Meeting of the Company was then held for the purpose of considering, and if thought fit passing, certain alterations in the Company's Memorandum of Association and a new set of Articles of Association. It was explained by the Chairman that, as the Memorandum and Articles of Association were registered so long back as 1875, they were now absolutely obsolete. The Directors had therefore deemed it advisable, on the advice of their Solicitor, to take the opinion of Counsel (Mr. F. B. Palmer), so as to bring them up to date, having regard to intervening decisions and to the provisions of the Companies' Act 1900.

The proposed alterations in the Memorandum of Association, and the draft of the new regulations, were then taken as read; and resolutions adopting them were unanimously carried.

A vote of thanks to the Chairman and Directors terminated the proceedings.

BOMBAY GAS COMPANY, LIMITED.

The Ordinary meeting of this Company was held last Thursday, at the London offices, No. 6, Drapers' Gardens, E.C.—Mr. ROBERT DAVIDSON in the chair.

The SECRETARY (Mr. J. Hill Perrins) read the notice convening the meeting; and the report and accounts—to which reference was made in the "JOURNAL" for the 29th ult., p. 1103—were taken as read.

The CHAIRMAN said it was with very great sorrow that they intimated in the report the death of Mr. Linging. He was greatly respected by his colleagues, and was a most excellent Director. Mr. E. A. Flinders (for many years Auditor of the Company) had been appointed to fill the vacancy at the Board; and Mr. Louis Penny (the Company's late able Manager at Bombay for seventeen years) had been selected to fill the auditorship which thus became vacant. Turning to the accounts, he said that the items showed a steady growth in the Company's business—especially in the important direction of the use of gas by private consumers, the rental from which showed an increase of more than £2000, or nearly 6 per cent. in the sale of gas over the previous year. The preceding year was also an excellent one, so that the figures were really even better than they looked. There was a slight falling off in the revenue from public lamps, for the reason mentioned in the report—namely, that there were more moonlight nights, when certain of the lamps remained unlit. They had not done so well in residual products; but this was only a natural consequence of the condition of trade in Bombay Presidency, which last year was very bad—resulting in the closing of many up-country sugar factories, and other large concerns which had been considerable purchasers of their coke. Every effort was, however, being made to open up fresh markets for their products. As regarded expenditure, they consumed some 2500 tons more coal; but as this was principally native coal, purchased in silver, the increased cost was considerably minimized by the reduced loss in exchange, which they would see was some £1829 less. During the high prices prevailing for English coal last year, they found that, in an emergency, they could get along with native coal alone; but the result of working with native coal had so far not been entirely satisfactory. The yield of gas was much less; and the residuals were also poor. Still it was something to find that they could, if put to it, get along with native coal, though, if procurable at anything like normal prices, and with freights also normal, English coal was much the best to work with. The other items of expenditure called for no special comment, except that of bad debts, which, they would observe, considerably exceeded the amount for many years past. The cause of this increase had been entirely plague and famine. Many of the native tradesmen had lost all their money, and shut up their places and disappeared; and it was difficult, or impossible, to trace them. He thought there was every prospect now that that the plague would die out—at least, he hoped it would do so. In conclusion, he might mention that the Manager regarded the prospects of the current year—which had commenced very well, there being a large increase in the private consumption—as of a most hopeful character. He was at the present time trying experiments with high-power incandescent lamps, several of which had lately been dispatched to Bombay, and from which he anticipated very advantageous results to the Company. The shareholders would notice that the Directors had been able to add £1500 to the reserve fund, and proposed to carry forward, after payment of the dividend, £641. He concluded by moving the adoption of the report and accounts, and the payment of a dividend of 3½ per cent., free of income tax (making 6½ per cent. for the year).

Major W. F. GORDON seconded the motion.

Mr. CUFF said he had hardly any remarks to make, for the position of the Company's affairs was very satisfactory. There were two points he had intended to allude to; but the Chairman had answered them. He referred to the questions of native coal and residuals. The only other point was the large amounts owing on the one side to creditors and on the other side by debtors. He should prefer to see both these items smaller, and the business kept up as close as they could possibly manage. He presumed that the Directors found some difficulty in this; but he could only hope that in the next report there would be a diminution in these two items.

The CHAIRMAN said the explanation of the large amounts outstanding was that they were owing their bankers a moderate sum of money pending the receipt of remittances from the other side. There had been very great difficulty in collecting the revenue, owing to the state of trade in India; and the amount outstanding was larger than they should like to see, thought it was less than in the corresponding period of the previous year.

Major GORDON proposed the re-election of Mr. Flinders as a Director; remarking that he was a gentleman of very varied experience, and one whom he considered would be a most satisfactory addition to the Board.

Mr. CHARLES GANDON, in seconding the motion, said he had known Mr. Flinders for very many years. He agreed with Major Gordon that Mr. Flinders would be a great acquisition to the Board, not only from his experience at home, but also in view of the fact that he had spent many years in India (particularly in Bombay), and was thoroughly conversant with Indian matters. This would be a great advantage to such a Company as theirs.

The motion having been carried, the other retiring Director (Mr. Gandon) was also re-elected, on the proposition of the CHAIRMAN, seconded by Mr. H. E. JONES.

The Auditors (Messrs. Magnus Ohren and Louis Penny) were next re-elected; and the proceedings closed with cordial votes of thanks to the Chairman and Directors and the Manager, Secretary, and staff both at home and abroad.

SOUTHAMPTON GAS COMPANY.

The Half-Yearly General Meeting of this Company was held last Wednesday—Dr. T. W. TREND, J.P., in the chair.

The SECRETARY (Mr. C. Crowther Smith) having read the notice convening the meeting, the report of the Directors was presented. They stated therein that there had been the very satisfactory increase of 19,211,000 cubic feet of gas sold during the half year ending December last, compared with the latter half of 1900. For the year 1901 the increase was 32,167,000 cubic feet—the maximum consumption ever attained. The Directors had felt justified in making a reduction in the price of gas, after the Lady-day quarter, of 2d. per 1000 cubic feet throughout the whole of the district, which would confer a benefit upon the consumers generally of at least £3700 per annum. The number of consumers on the prepayment meter system amounted to 5700, nearly all of whom were using gas-cookers. There were also 2480 ordinary gas-cookers on hire—these and gas-fires having become very popular. The accounts showed that, after payment of debenture interest and all other charges, the amount available for distribution was £11,982. The Directors recommended the payment of maximum dividends amounting to £10,089 for the half year on the ordinary stock, less income-tax. This would leave £1893 to be carried forward

The CHAIRMAN, in moving the adoption of the report, called attention to the fact that in 1901 the quantity of gas sold was 511,819,000 cubic feet, and during the preceding year 479,652,000 cubic feet—the increase being 32,167,000 cubic feet. This was the maximum consumption ever attained in any one year; the increase being 6·7 per cent. The proprietors were aware that in the June half of 1901, owing to the enormous advance in the price of coal and oil, the Company had to draw £3193 from the reserve fund to pay the shareholders their 5 per cent. maximum dividend. The Directors were able to congratulate the proprietors that for the December half of the year they had not to resort to it for dividend, but were able to carry forward £1893. As to coke and other residuals, the Company, together with all other gas companies, had suffered from the low price obtained for coke, tar, and

sulphate of ammonia during 1901; and they had thereby been affected to the extent of upwards of £4000, as compared with the two previous years. The amount of rates and taxes paid by the Company in 1901 was £4709, which was equal to more than 2½d. per 1000 cubic feet of gas sold; and this great burden was necessarily borne by the consumers in the price paid for gas The Company had joined with others in supporting Mr. Livesey in his successful endeavours against the Welsbach Company, which had resulted in the Company agreeing to considerably reduce the prices of their burners and mantles. The reductions made would be so considerable that gas consumers generally would be much benefited both by the increase in the illuminating power and the reduced cost of gas if they adopted this method of lighting. Several corporations in the kingdom, possessing both electric lighting and gas-works, had abandoned the lighting of public lamps by electricity, and had adopted incandescent gas lighting, as affording a great increase of illuminating power and a very considerable reduction in the cost to the ratepayers. It would be interesting to the proprietors if he gave a comparison showing the progress made by the Company from 1892 to 1901. The Southampton electric light works were started in the former year; yet, notwithstanding their establishment, the gas sold, in round numbers, in 1901, amounted to 511 million cubic feet, whereas in 1892 it was only 312 millions—thus showing an increase of 199 millions, or 63 per cent. in the ten years. The value of 1d. per 1000 cubic feet sold was in 1901 £2020, and in 1892 £1299—an increase of £721, or 55 per cent. The shareholders numbered 702 in 1901, and only 419 in 1892, or 283 less; while the dividends paid last year amounted to £19,704, which, compared with £15,077 in 1892, showed an increase of £4627. In 1892 the price of gas was 2s. 10d. per 1000 cubic feet in the town district, and 3s. 4d. in the outside districts; but, notwithstanding the enormous increase in the cost of coal and oil, the figures to-day were exactly the same. Coal and oil cost £39,489 in 1901, and £20,262 in 1892; the increase being £19,227. Rates and taxes last year came to £4709; whereas in 1892 the amount was £2892—the advance thus being £1817. The increased demand for gas had necessitated a large extension of the works, and the new capital recently raised at £105 was required in payment therefor. This conclusively proved the satisfactory progress of the Company; while the assurance in the future of cheaper coal and oil enabled the Directors to anticipate the continued prosperity of the undertaking.

Captain CORSE-SCOTT seconded the motion; and it was carried unanimously.

The dividends recommended having been declared, a vote of thanks was accorded to the Secretary, Manager (Mr. S. W. Durkin), and staff, and also to the Chairman and Directors, and the proceedings closed.

ROTHERHAM CORPORATION GAS SUPPLY.

The Past Year's Progress.

At the Meeting of the Rotherham Town Council last Wednesday, the Chairman of the Gas Committee (Alderman Gummer) made his annual statement. He said the make of gas during the past year had been 271,584,000 cubic feet, against 268,636,000 feet in the previous year—an increase of nearly 3 millions. While there had been a greater make there had been less gas consumed. The consumption had been 237,971,000 cubic feet, or a decrease of 717,000 feet. He could only account for this by the diminution in general trade, and by the competition of the electric light undertaking. The leakage had been 11·34 per cent., against 9·96 per cent. before, and 7 or 8 per cent. at other works in colliery districts. This question was receiving the careful attention of the Engineer (Mr. F. A. Winstanley). The consumers numbered 11,395—an increase of 637. Ordinary consumers—those using the ordinary type of meter – numbered 4387, or an increase of 45; and prepayment consumers 7008, or 592 more. Penny-in-the-slot gas-cookers, for which they had already received 500 applications, would shortly be supplied. With regard to the revenue account, the gross profit for the year was £9071; but after taking interest on debentures and the payment to the sinking fund, amounting to £8438, there remained a net profit of £633. This was an admittedly small sum, especially when they considered the amount of capital invested in the gas-works. How came it about, it might be asked, that the profit was so very small? He explained that the rate of interest they were paying on the debentures and loans was considerably above the average; and he suggested that the Finance Committee should take this question into consideration. The plant had been depreciated by £2170, rates and taxes had absorbed £2415 (an increase of £559), and coal had cost £17,880, compared with £18,124 in the year 1900-1. The average price per ton of coal, including cannel, was 14s. 8¾d.—against 14s. 11¼d. before, and 9s. 3½d. four years ago, when the department was making a profit. During the past year they had not received the full benefit of the reduced price of coal, owing, he contended, to his advice having been disregarded. Instead of 3d. per ton, they ought to have had 1s. or 1s. 1d. In the present year he considered it would be better to enter into the contracts for six months; but the Council had gone in for nine months. Although coal was now cheaper than when they contracted, they would have to take the supply at the high price until the end of August. He hoped that when the contracts were let for the coming year the Committee would be very careful, not only as to where they placed them, but also as to the price paid. There had been a decrease in the returns from residuals to the extent of £1634. He quoted statistics to show that Rotherham compared favourably with several other towns, and that the municipal working of the gas undertaking had not been detrimental. It was the mistaken policy of previous years which was at present affecting it. The works had been starved, and the Corporation had in recent years been compelled to make extensions; the result being that the works were now thoroughly up to date, and capable of meeting the requirements of the borough. In the face of the charges on the department, he did not anticipate any profit during the current year.

The Fleetwood Gas Company have placed an order with Messrs. R. Dempster and Sons, Limited, of Elland, for a new stack of regenerator settings of eight retorts on Waddell's patent tubular regenerator system.

MANCHESTER CORPORATION GAS AND WATER SUPPLY.

At the Monthly Meeting of the Manchester City Council held on Wednesday last, several important questions in connection with the Gas and Water Works Departments came up for consideration.

A Comparison of Sheffield with Manchester.

In the discussion on the motion to adopt the ordinary minutes of the Gas Committee,

Mr. G. SIMPSON drew attention to certain remarks with reference to the Manchester gas undertaking made by Sir Frederick Mappin, M.P., Chairman of the Sheffield United Gas Company. This Company had always paid 10 per cent. dividend; and Sir Frederick, referring to Manchester, remarked to the shareholders that consumers of gas in Sheffield should be thankful that the works had not been purchased by the Corporation, because the price of gas in Manchester, under the Corporation, was 2s. 9d. per 1000 cubic feet, against 2s. in Sheffield. The Manchester undertaking, he added, paid £50,000 a year in alleviation of the rates; but the Sheffield Company's undertaking, with a smaller consumption, would have been able, at Manchester prices, to hand over £102,000 towards the relief of the rates.

Alderman GIBSON (Chairman of the Committee) said the real test of comparison between one gas undertaking and another did not consist in taking little items here and there, or in the price which was charged for gas; but it did consist absolutely in the cost of carbonizing, distribution, and general management. He found that in this respect, at any rate, they could give Sheffield a very long start. Sheffield spent under that head—manufacture, management, and cost of distribution—30·3d. per 1000 cubic feet, for 17-candle power gas. Manchester spent 28·85d. for 19-candle power gas. This was very considerably in favour of the working of Manchester. Everybody who was acquainted with the manufacture of gas knew that to get this 17-candle power cost 2d. per 1000 cubic feet per candle; so that for the extra 2-candle power the gas in Manchester necessarily cost more by 4d. than it did at Sheffield. Then, owing to the better market for residual products, having regard to the local conditions of Sheffield, the Company there realized 5d. per 1000 cubic feet more for their coke, &c., than Manchester did. These two items made 9d., which accounted for the difference between 2s. 9d. and 2s. There was, however, a good deal more than that. The Sheffield rates were less than those of Manchester. In Manchester, they had, of course, to pay on the gas property, and the rates would make 1d. per 1000 on the candle power. Again, Sheffield got £13,000 a year for meter-rents; Manchester got nothing, as they made no charge for these. Altogether, if they were as favourably situated as Sheffield for the sale of residuals, they could sell gas at 1s. 10d. per 1000 feet, and make more profit than Sheffield was making. It had been said that Sheffield had always paid 10 per cent. dividend. For the half year June to December, 1901, they paid 10 per cent.; but in the previous half year, January to June, they had to take £14,600 out of the contingent fund in order to pay the dividend. The condition was therefore scarcely so rosy as Mr. Simpson seemed to think. Taking it all round, he believed there was no gas undertaking in the country conducted on more economical lines than that of the Manchester Corporation.

Sick Workmen and Their Wages.

The minutes of the Committee contained the following resolution on the above matter, which had already been before the Council (*ante*, p. 971): "That, having regard to the opinion expressed by the Deputy Town Clerk as to the legal liability of the Committee to pay the wages of workmen who are absent from their duties through sickness until the contract of service has been legally terminated, and without intending to deal with cases of workmen who are injured under circumstances entitling them to weekly sums (in lieu of wages) under the Workmen's Compensation Act, 1897, it be an instruction to the Superintendent, Engineer, and Managers, to give formal notice to terminate the service of any workman who is absent from his duties for two consecutive weeks, unless the Committee give special instructions to the contrary, or unless the workman waives his claim to wages."

Mr. F. BROCKLEHURST said it would be remembered that this question had come before them at the last Council meeting, and the resolution was now brought forward in a somewhat amended form. He had given some consideration to the matter since the last meeting; and he thought the objects of the Committee could be achieved without giving formal notice of dismissal to a workman who was compelled to be absent more than a fortnight through illness. He therefore begged to move, as an amendment, that the question be referred back.

Mr. GRIMSHAW seconded the amendment.

Mr. LAMBERT expressed surprise at Mr. Brocklehurst's amendment. Having regard to the language of the resolution, he should have thought no objection would have been taken to it. It stated that notice was to be given unless the Committee gave special instructions to the contrary, or the workman waived his claim for wages. This gave discretion to the Committee; and all who knew the members would have every confidence in them in regard to the exercise of that discretion.

Mr. ARRANDALE observed that he had been connected with workmen a great many years, and had never heard of one in receipt of either day or weekly pay claiming his wages when away ill; and he did not think any Trade Union organization would support a member who attempted to do such a thing.

Mr. BOYLE thought that if a scheme was to be introduced it should be a general one, and not apply simply to one Committee. He might also ask whether, when a man was engaged in the first instance, they could not make a contract not to pay his wages when he was sick, instead of giving him notice then.

Alderman GIBSON said he had no personal feeling in the matter. He was simply considering the interests of the mass of the ratepayers. The reason the subject was brought forward was that in one of the gas-works they found that at any rate three or four men were getting more money when they were not at work than when they were. When notice was given to them, they came back the very next day; and the Committee therefore thought some such measure as that proposed was required for their protection. There was no question as to the

legal position. Every employer was liable for a servant's wages so long as he was away ill; and it was quite possible workmen had not made claims because they did not know they had a right to do so. As to the way in which the Committee dealt with their workmen, there was a case where a man went up a ladder, which it was not necessary for him to go up, so far as his work was concerned. He fell and broke his leg, which had to be amputated. He had no claim on the Committee, and admitted that he had none; but, notwithstanding this, they had been paying him ever since, and would find him work when better, although he had only one leg. This showed the spirit in which they treated their workmen; and they simply wanted the resolution passed in order that they might have the whip-hand, so to speak. He thought it would be the wisest thing to do.

On the suggestion of Alderman Southern, Mr. Brocklehurst withdrew his amendment; and Alderman Gibson agreed to take the matter back, on the understanding that it should be further considered by the Chairmen and Deputy-Chairmen of the four large employing Committees of the Corporation, with a view of coming to some recommendation of a united character.

The High-Pressure Gas System.

Mr. Royle observed that as the high-pressure lamps round the Technical School had proved so successful, and Alderman Gibson had stated that the cost was considerably less than that of electricity, he would like to know if the Chairman would promise to make a trial of something of the kind in the streets about Shudehill, which were very badly lighted by ordinary gas-lamps. Two years ago the then Chairman of the Electricity Committee promised he would put up electric arc lamps in that locality; but nothing had been done.

The Lord Mayor (Alderman Hoy) said this was a very proper thing to bring before the Committee; but it was scarcely in order to ask the Chairman for a promise on the matter.

Reduction in the Price of Gas for Motive Purposes.

Alderman Gibson proposed that the price of gas used for motive or power purposes be reduced, as and from the 30th of September, by 9d. per 1000 cubic feet—*i.e.*, from 2s. 9d. to 2s. within the city, and from 3s. to 2s. 3d. without the city, subject to the gas so used being supplied through separate fittings to be provided by the consumer. He thought it would be admitted that the cheaper the price at which a manufacturer could obtain the power for his machinery, the better able would he be to enter into competition with others, the more labour was he likely to employ, and the better would it be for the community all round. This was one main reason why the Committee had recommended a reduction in the price of gas for power purposes. There was, however, another reason, which weighed very strongly with them, and that was the advent of Mond gas. This gas had come to stay; and there was no doubt that it could be manufactured and supplied for power purposes at something like 3d. per 1000 cubic feet. Even taking into account that four or five times the quantity of Mond gas was required to produce the same result as ordinary gas, it would only bring the cost to an equivalent of 1s. per 1000 cubic feet of ordinary gas. He and the Committee were of opinion that they should place themselves in a position to fairly compete with this Mond gas undertaking, which, he might tell them, was already established in Trafford Park, very near to their own borders, and show evidence of a desire to do the best they could to promote an increase in the use of gas-engines in Manchester, so as to enable the smaller manufacturers to make progress. A short time back, the Mond gas undertaking secured the power to supply an area of 135 square miles in the Black Country, in the face of the most determined opposition on the part of every Gas Company and Corporation in that district; and although they in Manchester might say they could not allow any other Company to put down mains in their streets—which were already over-crowded—he did not think that would have very much weight. They could not prevent Parliament doing to Manchester what had been done in the Black Country, and giving power to any company to come into their streets, if they did not demonstrate that they were themselves prepared to do the best they could for those who wanted cheap power for business purposes. What they had to do was to prepare themselves for any competition which might present itself, and show that they were doing all they could to supply customers on the best terms.

Alderman Briggs seconded the motion.

Mr. Heenan said he took great interest in the question of reducing the price of motive power in Manchester. Speaking not as a member of the Council but as a manufacturer, he thought it would be a good thing for trade if they could create competition between the Chairman of the Gas Committee and the Chairman of the Electricity Committee. He thought, however, the Chairman of the Gas Committee had overstated the weakness of his enemy, Mond gas. He knew for a fact that Mond gas could be produced at 0·1d. per horse power per hour. Taking gas at 2s. per 1000 cubic feet, which the Chairman proposed, the reduction would not bring the price of horse power down to anything like that at which the Mond gas people could supply it. If he had anything to say as to the price to be fixed for motive power, he would reduce it to 1s. 6d. or 1s. per 1000 cubic feet; and it was possible that if it were reduced to 1s., the ratepayers of Manchester would save, and not lose, by the transaction. As to getting the streets cut up, and large pipes laid down for Mond gas, this was not necessary. A Mond gas plant for 10,000-horse power could be put in a comparatively small space, and would not cost more than £20,000 to £30,000. If the Gas Department did not look out, he feared the time was not far distant when there would be great opposition from the use of Mond gas.

Mr. Sutton agreed with Alderman Gibson as to the competition of Mond gas. At the same time, the Committee ought, if possible, to do something in the way of reducing the price of gas for lighting, heating, and cooking purposes. He therefore begged to move that the matter be referred back, with a view to this being done. If 3d. per 1000 cubic feet were taken off for lighting, cooking, and heating, they might take 6d. off the price for motive power.

Alderman Southern thought that what Alderman Gibson proposed might be done, not only without any burden on the rates, but with distinct advantage. It would serve two most important ends. In the first place, he might say that the pollution of the atmosphere in that city was not chiefly caused by the large manufacturers, who could afford to lay down devices for automatic stoking, and the better combustion of fuel, and the reduction of smoke. Those who caused most pollution were people who were trying to produce in a small place more power than their boilers really permitted them to obtain, and so overfired them. The more they encouraged the use of the gas-engine, the more they would reduce the frightful pollution of the atmosphere in Manchester. In the second place, they would provide a stimulus to the use of gas, which would keep the plant better employed all through the year. They had been putting down some works on the Ship Canal, and had had to consider what was the most economical way of providing power and distributing it. Ultimately, they decided to put in gas power, and distribute it electrically. In his opinion, the Corporation would be doing a wise thing in reducing the price of gas for power purposes.

Mr. Fildes said they were immensely behind in this matter. Leicester and Darwen had both recently reduced their charges for gas for motive power. In Sheffield, they had 187 gas-engines at work; and these used 189 million cubic feet per year. Leeds and Bradford were also forging ahead in this matter. Birmingham had recently adopted the hire-purchase (three years) system for gas-engines, and were letting them out in the ordinary way, as the Manchester Committee did with gas-stoves.

Mr. Brocklehurst also supported the proposal. He thought, however, that it ought to be clearly understood that, although the price was to be 2s. and 2s. 3d., these were not to be taken as permanent figures. The price would fluctuate with the price of coal. While pushing the use of gas-engines would be of material importance in diminishing the pollution of the atmosphere, it would not be of so great a value as would be the encouragement of the use of cookers in cottage homes; and he hoped the Gas Committee would take this matter into consideration at a later date.

Mr. Samson proposed an amendment to the effect that the reduction in the price of gas for power purposes should be limited to the city.

Mr. Grime seconded the amendment.

Alderman Gibson said the out-districts already paid 20s. for what was supplied to the ratepayers for 18s. Surely 10 per cent. was a sufficient distinction.

Ultimately, the Committee's recommendation was adopted.

Iron *v.* Steel Pipes for Water-Mains.

Mr. J. Simpson moved a resolution to the effect that the Water-Works Committee be instructed to consider and report upon the expediency of substituting steel for cast iron in the composition of water-mains, and for this purpose to cause inquiries to be made by a deputation at places in the United Kingdom and on the Continent in which steel pipes were used. He contended that, on the grounds of both economy and efficiency, steel pipes were preferable. In many large cities and towns in England and on the Continent, as well as in America, steel tubes were being used; and at the present time something like 360 miles of steel tubing were being put down for water-mains in West Australia. Taking the saving in cost of carriage, the making of joints, and the material required, &c., he believed the use of steel pipes would mean a gain to the city of £100,000.

Mr. Grimshaw seconded the motion.

Alderman Sir Bosdin Leech, in the absence of the Chairman of the Water-Works Committee (Sir John Harwood) through illness, replied that the Committee had taken every step to ascertain the respective merits of iron and steel; but they were advised that the endurance of steel pipes had not been tested over a sufficiently long period to render their substitution for iron pipes advisable, though even at present they were going to use steel pipes at certain special points. While they knew that iron pipes were satisfactory, as they were now taking up Woodhead pipes that had served for fifty years, there were no steel pipes which had been in use longer than eleven years. The Committee were in no way conservative on the question, and if they found it desirable to substitute steel for iron, they would be quite ready to do it; but at present the advice given them was to the contrary.

Mr. Heenan said the life of steel was in no way comparable with that of cast iron. If they wanted to put down a job without any anxiety about it, they must use cast iron. If they employed steel it would always be a source of anxiety, because there were so many agencies which shortened its life.

On being put to the vote, the motion was defeated.

SALFORD CORPORATION GAS SUPPLY.

Reduction in Price.

At the Meeting of the Salford Town Council last Wednesday, Mr. Alderman Phillips moved the adoption of a resolution of the Gas Committee to fix the prices for gas in the borough and out-districts as follows: Salford, Eccles, Swinton, and Pendlebury, for ordinary consumers, 2s. 10d. per 1000 cubic feet; consumers of 250,000 and under 500,000 cubic feet per quarter, 2s. 9d.; of 500,000 and under 1,000,000 cubic feet, 2s. 8d.; and of upwards of 1,000,000 cubic feet, 2s. 7d. In the districts of Worsley and Prestwich, and the rural district of Barton, comprising Clifton, Davyhulme, and Barton Moss, the price to ordinary consumers was to be 3s. per 1000 cubic feet, and the charges to consumers of the quantities set out above ranged from 2s. 11d. to 2s. 9d.; in the urban district of Little Hulton, ordinary consumers were to pay 3s. 2d. and the prices to others ranged to 2s. 11d.; in the urban district of Irlam and Cadishead, ordinary consumers were to pay 3s. 3d., and the prices to other consumers as stated ranged from that sum to 3s. The Committee further recommended—"That the discount of 2d. per 1000 cubic feet of gas allowed to all consumers within and without the borough who pay their gas bills within one month from the delivery of the accounts be increased to 4d. per 1000 cubic feet." Alderman Shaw seconded the motion. In answer to Mr. Barker, Alderman Phillips said the Committee were not in a position to reduce the charge to those who had penny-in-the-slot meters, in consequence of the expense of the system. Mr. Jackson thought it was to be regretted that nothing could be done in the interest of poor people to

make a reduction. Mr. Wheatcroft pointed out that if the small consumer paid his account within a month, he would benefit by the increased discount to be allowed. Mr. Yearnshaw remarked that those who used the penny-in-the-slot meters would only be paying the same as they did before the increase in the price last year, which had not affected them. The resolution was adopted.

DUKINFIELD CORPORATION GAS SUPPLY.

The Past Year's Working.

The Gas Engineer and Secretary to the Corporation of Dukinfield (Mr. Harrison Veevers) has presented his report for the year ending the 31st of March. He states therein that the high price of coal in the previous year had the effect of increasing the price during 1901-2. Though the average rate per ton was 2s. 9d. less than in 1900-1, it was 1s. 7d. more than that of the past ten years. The loss on the year's working (exclusive of the cost of the rebuilt retort-house and the regenerative furnaced retort-stack) was £877, against a loss of £492 in the preceding year; and for this there were adequate reasons. The repairs of mains in the works and district were unusually heavy through subsidences of the ground, to which may be attributed the great increase in the leakage, amounting to 15½ million cubic feet, or at the rate of 16·05 per cent. on the total make; exceeding that for 1900-1 by 5·2 per cent., and the average of ten years by 6·45 per cent. This leakage is the most serious feature of the balance sheet. There are 973 prepayment meters in use, of which 168 were fixed last year; and so great has been the demand for cookers, that 100 have been added. The gas accounted for (81,283,500 cubic feet out of a total make of 96,821,000 cubic feet) was used by the following consumers:—

	1902.	Per Cent.	1901.	Per Cent.
Cottages—				
Ordinary meters	38,876,000	47·83	37,881,300	49·04
Prepayment ,,	7,501,650	9·23	6,604,075	8·55
Mills	27,693,480	34·07	25,161,718	32·57
Public lamps	5,776,991	7·11	6,247,178	8·09
Used in works, offices, &c.	1,435,379	1·76	1,353,358	1·75
	81,283,500	100·00	77,247,629	100·00

The accounts accompanying the report show that the gas-rental in the past financial year amounted to £11,369, compared with £10,800 in the year 1900-1; the total revenue being £13,941 against £14,206. The expenditure was £12,622, against £11,736; and the balance £1319, compared with £2470. Adding to the first-named sum £20 for cottage rents, there was not sufficient money to meet annuities, interest, and sinking fund charges by £1805, which had to be taken from the balance of the profit and loss account, reducing it to £157. The net cost of gas production, exclusive of capital charges, was 2s. 5·68d. per 1000 cubic feet; but with these added, it is brought up to 3s. 2·9d. As the average price of gas is 2s. 9·57d., there is a loss of 5·33d., compared with 1·53d. for the preceding year. A table giving the various items of the balance-sheets from 1892 shows that the income from gas in that year was £7943, with the price of gas at 2s. 11d. per 1000 cubic feet, varying, according to consumption, 1d. to 5d., and no meter-rents charged to consumers of less than 50,000 cubic feet per quarter. Two years later, the price was raised to 3s. 2d.; but it was brought down again in 1895 to the former figure, at which it has since remained.

The report summarized above came before the Town Council in the minutes presented by the Gas Committee at the meeting on Monday evening last week. In the unavoidable absence, through illness, of Mr. Cooke, the Chairman of the Committee, the Mayor (Mr. W. E. Wood) moved the adoption of the minutes. Referring to the financial position of the undertaking, he said it was a matter for extreme regret to the Chairman of the Committee and the whole of the Council to find that they had been unable to make a profit. In this, however, they were not alone, though, of course, that was no great consolation. They would find from the balance-sheet that the loss was about £870. This was due to some extra work that had been carried out which in the nature of things would not occur again for several years. Notwithstanding the apparently bad financial position, he thought there was still room for hope. One of the unfortunate features in the balance-sheet was the enormous leakage that had taken place during the year, as compared with that of the previous year. It was equivalent in money value to nearly £700 more. The normal leakage had been something like 9·3 per cent. in the past ten years, while last year alone it had actually been a little more than 16 per cent. This was a matter which called for the very serious attention of the Committee, who would have to decide what they would do to prevent this enormous waste. Mr. Stafford seconded the motion, and expressed regret at the condition of the balance-sheet. In the year 1900-1, the cost per million cubic feet of gas was £169 4s. 6d., whereas last year it was only £162 11s., or £6 13s. 6d. less; and yet there was a loss of £877. In 1900 there was a profit of £1506; in 1899, of £1075; and the year before that, of £517—a total in the three years amounting to £3098. It struck him forcibly that some attempt should be made to discover why the present heavy loss of £877 had come about. The gas-works being practically new since the Manager came to them, he (the speaker) was anticipating a reduction in the price of gas. He thought some attempt should be made to discover why the loss last year had been entailed. In his own opinion, the works were being overbuilt for posterity to the tune of something like £3000 or £4000. He contended that the spending of this money was not strictly business, and not fair to the gas consumers, because while new works were being built there was no relief to those who consumed gas. His conclusion was that the producing power of the works at the present time was much beyond the requirements of the town. They ought to leave well alone. Reference had been made to the price of coal. He found that in 1894 they paid 14s. 0¾d. per ton; in 1901, 16s. 3d.; and in 1902, 13s. 6d.—being 2s. 9d. per ton cheaper, and yet the loss had come out so great. The Mayor, in putting the motion, said he had no objection to Mr. Stafford, a former Chairman of the Gas Committee, having all the honour and glory attached to the different profits made in the years he had mentioned; but if he had been paying 16s. 3d. or even 13s. 6d. per ton for coal, and had the present leakage, those handsome profits would have become very large losses. The minutes were adopted.

THE PUBLIC LIGHTING QUESTION AT BRISTOL.

The question of the obligation of the Bristol Gas Company to supply gas to the public lamps of the city has for some time past been the subject of some friction between the Company and the Corporation; and at a special meeting of the Sanitary Committee held on Wednesday, certain members took an opportunity of giving vent to their grievances. The matter arose in this way: At the beginning of April, the Committee recommended an extension of public electric lighting; whereupon the Secretary of the Gas Company (Mr. John Phillips) wrote to the members of the Council to the effect that the city would be out of pocket to the extent of £6092 per annum by adopting the scheme, in addition to which the streets not included would lose the benefit of improved lighting. The letter appeared to indicate an intention on the part of the Company to penalize the Corporation for extending public electric lighting by preventing the adoption of incandescent gas lighting. Correspondence passed between the Town Clerk and the Company, with the view of ascertaining the clear intention of the latter; and, as a result of this, the Committee were informed that if the Corporation extended the public electric light the Company would not supply gas to the public lamps when fitted for incandescent lighting, and keep them in repair, at the price they had previously quoted—viz., £2 12s. 6d. per lamp per annum. As to the legal position of the matter, the Town Clerk informed the Committee that, according to sections of the Gas-Works Clauses Act, 1871, the Company were bound, and could be compelled, to supply gas to every public lamp within 50 yards of any of their mains, in such quantities as the Local Authority might require—any dispute as to the supply, consumption, or price to be charged to be settled by arbitration. The quantity of gas consumed might, at the option either of the Local Authority or the Company, be ascertained by meters; and the cost of providing and fixing the appliances was to be borne by the party requiring them. The effect of these provisions was, the Town Clerk pointed out, that if the Corporation chose to fit up the public lamps for incandescent lighting, the Gas Company were bound to supply them with gas; and if, as the result of employing the incandescent system, less gas would be consumed, the Company could charge only for the reduced quantity. The Company would be bound to estimate the quantity of gas consumed according to the number of cubic feet per hour which a No. 4 Kern burner was known by experience to burn, just as they now estimated the consumption by experience of that which an ordinary burner was known to pass. If the Company were not satisfied with this mode of ascertaining the consumption, they might require the adoption of meters, in which case the Corporation would have to pay for the quantity of gas registered thereby, but the Company would have to pay the cost of providing the meters. The Corporation could not require the Company to light and extinguish the lamps or to maintain them. The result, therefore, was that the Company could not prevent the Corporation enjoying the benefit of incandescent lighting, but might put them to the inconvenience of arranging for the appointment of a staff to light, extinguish, and repair the lamps.

This situation was discussed at length, and one member of the Committee (Mr. Baston) expressed the opinion that the Corporation had sold themselves to the Gas Company by the terms they had placed before them. After various other views had been expressed, it was agreed that the present negotiations with the Company relative to incandescent lighting must be considered at an end. The Chairman (Mr. S. Lloyd) afterwards pointed out that there were two courses open—one to ask the Company what they would supply light for in the gas-lighting area after the electric light extension; and the other for the Committee to get facts and figures before them so as to know what they could themselves do the work for in connection with the care of the gas-lamps. It was eventually decided to take steps in accordance with the suggestion of the Chairman. Replying to a question, he said the lamps were extending at the rate of three or four miles a year.

Proposed Improvement of the Teignmouth Gas-Works.—The Teignmouth District Council had before them last Tuesday a report by Messrs. T. Newbigging and Son on the proposed alterations at the gas-works. They were generally in accord with the recommendations of the Gas Manager (Mr. J. A. Gray), and set forth that he deserved the support and confidence of the Council in carrying the alterations to a satisfactory conclusion. The estimated cost is £3230.

Chard Town Council and the Gas-Works.—A meeting of the Chard Town Council was held last Tuesday, when the Parliamentary Committee presented a report on the proceedings in connection with the opposition to the Bill promoted by the Chard Gas Company. The Committee said they had carefully considered the question of purchase, and, after discussing it with Mr. Valon, were strongly of opinion that it would be greatly to the interest of the town to promote a Bill to take advantage of the purchase clause in the Company's Bill. They therefore recommended that statutory meetings of the Council and the ratepayers should be called for the purpose. The Mayor (Mr. T. Harris Mitchell), in moving the adoption of the report, said he was strongly in favour of the course recommended by the Committee. Mr. J. Hockey expressed the opinion that if they could purchase the works at the present value, the Council would be unanimously in favour of the scheme. There was no doubt that if they did not take advantage of this opportunity, the shares would be enhanced in value by 25 per cent. Mr. J. Gillingham thought the question of the possible introduction of electric lighting in the local factories ought to be considered. If this should be done, it would reduce the revenue received from gas consumers by a very considerable amount. The Mayor thought this was a matter which might be considered at a later stage, and could be brought under the notice of the arbitrator if they decided to purchase the works. The recommendations were adopted and the Committee were thanked for their services.

A LARGE HIGH-PRESSURE GAS INSTALLATION.

The Market Hall of Bolton is favoured among such centres of commerce; and it is now in every sense a place of light and leading. Concurrently with its redecoration, it has been fitted throughout on the Keith high-pressure gas system—the contractors being the James Keith and Blackman Company, Limited. The hall is fitted with upwards of 250 burners; and as each gives a light of 300 candles, there is an aggregate illuminating power of nearly 80,000 candles. This, we believe, is the largest single installation in the country. The cost is estimated at 1d. per 1000 candles per hour. The Corporation Markets Committee are very favourably impressed by the lighting; and the testimony of a local paper is that "the hall is brilliantly lit with a pure white, diffusive, and noiseless light." The Keith high-pressure system has been on exhibition at Hawick, Edinburgh, Stirling, Kirkcaldy, and other places; and it may interest readers in the localities to know that arrangements are being made for displays at Kendal and Dundee. The Company's stand at the Laundry Exhibition at the Agricultural Hall is also illuminated by the system.

DEVONPORT GAS-WORKS PURCHASE.

At a Meeting of the Devonport Town Council last Thursday, the Gas Committee submitted a report on the subject of the transfer of the undertaking. It appears from this that on the 10th of April the Town Clerk sent to Mr. E. E. Gard, Solicitor to the Gas Company, a skeleton account of the amount to be paid to the Company on completion of the purchase, so that they might insert certain figures to be supplied by them. On the 22nd, the Town Clerk pressed for a return of the account, with the required particulars, in order that a cheque might be drawn for the amount of the purchase-money. To this Mr. Gard replied on the following day that he was unable to return the account; contending that the Company were entitled to the gas-rentals and other debts due on Dec. 31, 1901, amounting to about £13,000, and stating that he could not conceive that the Umpire intended his award to be *minus* this large amount. The Committee resolved—"That, as the Corporation is unable to obtain the receipt of the three Directors of the Company for the moneys to be paid by the Corporation to the Company, the amount of the Umpire's award—viz., £149,570—be forthwith paid into the Bank of England to the account of the Paymaster-General of the High Court." These minutes were confirmed without comment, though, as was stated in the "JOURNAL" last week, the matter has been so far arranged that the Corporation have taken possession of the works, on payment of £141,000, without prejudice to the Company's right to sue for the balance of their claim. The Company are allowed until the end of the present month to decide whether they will pursue it. The Gas Committee also reported that they had accepted a claim of £7500, exclusive of reasonable costs, in respect of a notice to treat served on Lord St. Levan for the acquisition of additional land for the purposes of the gas-works. The Gas Engineer (Mr. S. E. Stevenson) reported that the cost of extending the mains to the added district of St. Buddeaux would be £5100; and the Committee directed that the work should be carried out.

INCREASED STORAGE AT THE PINNER GAS-WORKS.

The great development of the pretty little village of Pinner which has taken place since additional railway communication has brought it into closer touch with the Metropolis, has necessarily brought an increase in the business of the Pinner Gas Company, and consequently entailed an extension of their plant. The special need lately experienced has been more storage; and this is now being provided by the erection of an additional holder by Messrs. C. & W. Walker, Limited, of Donnington, under the supervision of Mr. Eli Bull, the Manager of the Gas Company. It will work in an iron tank 260 feet in circumference, and be capable of containing 250,000 cubic feet of gas. The concrete foundation for the tank having been completed, the bottom and first tier of plates were recently lowered on to it, in the presence of the Chairman of the Company (Mr. A. W. Marshall), Mr. Bull, and a numerous attendance. The tank is of steel, and the portion placed in position weighed 83 tons. About 30 men were stationed at the various levers, and the mass of metal, which was about 3 feet above the bed, was lowered in an hour. When completed, this will be the fourth holder possessed by the Company. The first was erected in 1864, and had a capacity of 7000 cubic feet. It was sufficient for some years for meeting the needs of the village, which did not then show signs of growing beyond the natural rate. When Londoners were enabled to take up their residence in the midst of its picturesque surroundings, the second holder—this time one for 14,000 cubic feet—was called for. But the place still grew, and the inhabitants showed their appreciation of the advantages of gas by burning it in larger quantities. As a consequence, another holder was needed, and one of 58,000 cubic feet capacity was provided. This was put up only a few years ago, and a further addition in the near future was not then contemplated. This, however, has come about; and it may be safely predicted that finality has not been reached.

The "Birmingham Post" says it is already apparent that gas will be the principal illuminant on the night of the Coronation, though, of course, there will be much use of electricity. The Bank of England, which is spending over £1000 on its illumination, remains true to gas; and the same spirit of conservatism is to be observed all over the City. One firm alone has contracts in hand that will require the use of over 150 miles of pipes, and something like half-a-million gas-jets.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 1283.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
590,000	10	Apl. 11	10½	Alliance & Dublin 10 p.c.	18—19	..	5 10 6
100,000	10	,,	7½	Do. 7 p.c.	13—14	..	5 7 2
300,000	100	Jan. 2	5	Australian 5 p.c. Deb. .	100—102	..	4 18 0
200,000	5	Nov. 13	6⅔	Bombay, Ltd. . . .	6¼—6⅝	..	4 16 4
40,000	5	,,	6¼	Do. New, £4 paid	4¼—4⅝	..	5 9 5
380,000	Stk.	Feb. 13	12	Brentford Consolidated	255—260	−2	4 12 4
270,000	,,	,,	9	Do. New . . .	188—193	..	4 13 3
50,000	,,	,,	5	Do. 5 p.c. Pref. .	128—133	..	3 15 2
206,250	,,	Dec. 13	4	Do. 4 p.c. Deb. .	112—115	..	3 9 7
220,000	Stk.	Mar. 13	10	Brighton & Hove Orig.	205—210	+2	4 15 3
246,320	,,	,,	7	Do. A. Ord. Stk. .	147—152	..	4 12 1
420,000	20	Apl. 11	10	British.	40—41	..	4 17 7
50,000	10	Feb. 13	12	Bromley, Ord. 10 p.c. .	23—25	..	4 16 0
82,850	10	,,	9	Do. 7 p.c. . . .	18—20	..	4 10 0
500,000	10	Oct. 11	6	Buenos Ayres (New) Ltd.	10—11	..	5 9 1
220,000	Stk.	Dec. 30	4	Do. 4 p.c. Deb.	94—97	..	4 2 6
150,000	20	Mar. 13	8½	Cagliari, Ltd. . . .	21—23	..	7 3 6
100,000	10	Sept. 27	10	Cape Town & Dis., Ltd.	15—16	..	6 5 0
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	53—55*	..	5 9 1
550,000	Stk.	Apl. 11	12	Commercial Old Stock	267—272	..	4 8 3
236,425	,,	,,	9	Do. New do. .	205—210	..	4 5 9
238,237	,,	Dec. 13	4½	Do. 4½ p.c. Deb.	130—135	..	3 6 8
800,000	Stk.	,,	9	Continental Union, Ltd.	145—150	−3	6 0 0
200,000	,,	,,	7	Do. 7 p.c. Pref.	155—160	−2	4 7 6
575,000	Stk.	Feb. 27	5	Crystal Palace Ord. 5 p.c.	120—125	..	4 0 0
60,000	,,	,,	5	Do. 5 p.c. Pref.	122—127	..	3 18 9
486,090	10	Jan. 30	10½	European, Ltd. . . .	18¾—19½	..	5 7 8
354,060	10	,,	10½	Do. £7 10s. paid	13⅝—14½	..	5 8 8
15,243,200	Stk.	Feb. 13	4 10/16	Gas-light and Coke	4 p.c. Ord. . .	92—94	.. 4 13 7
2,600,000	,,	,,	3½		3½ p.c. max. .	89—91	.. 3 16 11
3,799,735	,,	,,	4		4 p.c. Con. Pref.	108—110	−½ 3 12 9
4,193,975	,,	Dec. 13	3		3 p.c. Con. Deb.	90—92	.. 3 5 3
70,000	10	Nov. 13	8	Hongkong & China, Ltd.	13—14	..	5 14 4
3,800,000	Stk.	Nov. 13	10	Imperial Continental .	210—213	−1	4 13 11
473,600	Stk.	Feb. 13	3½	Do. 3½ p.c. Deb. Red.	100—102	..	3 8 8
561,000	Stk.	Feb. 27	10	Liverpool United A	216—219	−3	4 11 4
718,100	,,	,,	7	Do. do. B .	166—168	−2	4 3 4
306,083	,,	Dec. 30	4	Do. do. Deb. Stk.	118—120	..	3 6 8
75,000	5	Dec. 13	4	Malta & Medn., Ltd. .	4¼—5	..	4 0 0
560,000	100	Apl. 1	5	Met. of	5 p.c. Deb.	105—109	.. 4 11 9
250,000	100	,,	4½	Melbourne	4½ p.c. Deb.	101—103	.. 4 7 5
541,920	20	Nov. 13	3½	Monte Video, Ltd. . .	9¾—10⅝	..	6 13 4
1,595,892	Stk.	Feb. 21	4⅝	Newc'tle & G'tesh'd Con.	106—108	−½	4 1 0
346,855	Stk.	Dec. 27	3½	Do. 3½ p.c. Deb.	98—100	..	3 10 0
150,000	5	Nov. 28	8	Oriental, Ltd. . . .	7¼—7⅞	..	5 3 3
135,000	4½	,,	8	Do.	6⅝—7	..	5 2 11
15,000	1	,,	8	Do.	1¼—1⅜	..	4 11 5
60,000	5	Mar. 13	7	Ottoman, Ltd. . . .	6⅝—6¾	+⅛	5 3 8
851,070	10	Apl. 25	7	River Plate Ord. . .	10—10⅛*	..	6 13 4
250,000	Stk.	Dec 30	4	Do. 4 p.c. Deb..	95—98	..	4 1 8
250,000	10	Mar. 26	8	San Paulo, Ltd.. . .	11½—12¼	..	6 8 0
135,000	Stk.	Mar. 13	10	Sheffield A	239—241	..	4 3 0
209,984	,,	,,	10	Do. B	238—240	..	4 3 4
523,498	,,	,,	10	Do. C	237—239	..	4 3 8
5,850,000	Stk.	Feb. 13	5	South Met., 4 p.c. Ord.	120—122	−1	4 2 0
1,627,965	,,	Jan. 16	3	Do. 3 p.c. Deb. . .	92—94	..	3 3 10
380,940	Stk.	Nov. 13	5	Southampton Ord. . .	104—108	..	4 12 7
70,825	,,	Jan. 16	4	Do. 4 p.c. Deb.	100—102	..	3 17 8
120,000	Stk.	Feb. 27	5½	Tottenham and Edmonton	A. 5 p.c.	120—125	.. 4 8 0
260,520	,,	,,	4		B. 3½ p.c.	95—100	+2 4 0 0
182,380	10	Jan. 16	5	Tuscan, Ltd.. . . .	7—8	..	6 5 0
149,900	10	Jan. 2	5	Do. 5 p.c. Deb. Red.	97—100	..	5 0 0
230,000	5	Mar. 13	9	West Ham, 10 p.c. . .	9—10	..	4 10 0
172,000	10	,,	6	Do. 7 p.c. . .	12½—13½	..	4 8 11
140,900	Stk.	Dec. 30	4	Do. 4 p.c. Deb.	105—110	..	3 12 9
				WATER COMPANIES.			
780,599	Stk.	Dec. 30	11½	Chelsea, Ord. . . .	305—315	−5	3 13 0
150,000	,,	,,	5	Do. 5 p.c. Pref. .	155—160	..	3 2 6
160,000	,,	,,	4½	Do. 4½ p.c. Pref. '75	140—145	..	3 2 1
175,785	,,	Mar. 26	4½	Do. 4½ p.c. Deb. .	140—145	..	3 2 1
1,720,560	Stk.	Mar. 26	8	East London, Ord.. .	205—210	..	3 16 2
654,740	,,	Dec. 13	4½	Do. 4½ p.c. Deb. .	143—148	..	3 0 10
1,018,046	,,	,,	3	Do. 3 p.c. Deb. .	96—98	..	3 1 3
700,000	50	Dec. 13	8	Grand Junction	10 p.c. max..	113—118	−2 3 7 10
310,000	Stk.	Mar. 26	4		4 p.c. Deb..	127—130	.. 3 1 7
708,000	Stk.	Feb. 13	16	Kent	300—310	..	5 3 3
160,000	,,	,,	7	Do. New, 7 p.c. max..	200—210	..	3 6 8
1,043,800	100	Dec. 30	10½	Lambeth, 10 p.c. max..	295—300	..	3 10 0
406,200	100	,,	8	Do. 7½ p.c. max..	210—220	..	3 12 9
350,000	Stk.	Mar. 26	4	Do. 4 p.c. Deb..	125—130	..	3 1 7
500,000	100	Feb. 13	12 8/10	New River, New Shares	405—415	..	3 1 8
1,000,000	Stk.	Jan. 30	4	Do. 4 p.c. Deb..	127—130	..	3 1 7
902,300	Stk.	Dec. 13	7	South-wark and	Ord. . . .	193—198	.. 3 10 8
126,500	100	,,	7		7½ p.c. max.	185—190	.. 3 13 8
489,200	Stk.	,,	5		5 p.c. Pref..	153—158	.. 3 3 3
1,019,585	,,	Apl. 11	4	Vauxhall	4 p.c. A Deb.	125—130	.. 3 1 7
1,155,066	Stk.	Dec. 13	10	West Middlesex. . .		285—295	−5 3 7 9
200,000	,,	,,	4½	Do. 4½ p.c. Deb..		140—145	.. 3 2 1
200,000	,,	Mar. 13	3	Do. 3 p.c. Deb. .		95—97	.. 3 1 10

* Ex. div.

GAS v. ELECTRIC LIGHTING IN PADDINGTON.

At the Meeting of the Paddington Borough Council last Tuesday, the Electric and Gas Committee presented a report stating that they had been in communication with the Metropolitan Electric Supply Company, Limited, relative to the price charged for lighting Westbourne Terrace with electricity. At present, the Company supplied, for the sum of £30 per arc lamp per annum, in addition to the energy, the lamps, mains, carbons, and all labour involved in trimming and maintenance. There being 14 lamps in the thoroughfare, the total sum paid was £420 a year. The Company, having regard to the small number of lights installed, declined to reduce their charges. Pursuant to instructions, the Surveyor of the Council (Mr. G. Weston) prepared schemes for the reinstallation of a system of gas lighting. The Committee favoured one of them (No. 4), by which it was proposed to place 50 lamps fitted with Welsbach incandescent No. 4 Kern burners at a distance of about 15 yards apart, and two refuge lamps, each provided with a three-light cluster of incandescent burners. The initial cost was estimated at £199 7s. 8d. (including taking down, removing, and disposing of the two refuge arc-lamp columns), and the maintenance charge at £168 16s. The estimated annual saving by the use of gas was £253 14s. Finally, the Committee recommended: (*a*) That the Council adapt the foregoing scheme, and that the same be referred to the Works Committee to carry out; (*b*) that the Town Clerk be instructed to give three months' notice, as from Midsummer next, to the Metropolitan Electric Supply Company to terminate the arrangement under which Westbourne Terrace has been lighted with electricity. Replying to a question, Colonel Barchard, the Chairman of the Committee, stated that personally he did not think the terrace would be as brilliantly lit under the new arrangement as now. The Surveyor, however, was of opinion it would be sufficiently lighted by gas. Mr. Blackwood said they had been five years experimenting with electric light, with unsatisfactory results; and the sooner they left off the better. Colonel Blair considered that as the borough was badly lit at present, the Council should devote their energies to putting mantles on the lamps in the side streets. Westbourne Terrace could very well be left as at present until this was done. Other members supported this view. In the result, the consideration of the report was adjourned for six months.

ELECTRIC LIGHTING NOTES.

Electric Light Works for Mansfield.

Last Tuesday afternoon the foundation stones were laid for the electric light and power supply works at Mansfield. The scheme forms one of the most important that has been undertaken by the Town Council, and involves an expenditure of about £50,000. It includes the provision of a refuse destructor. One stone was laid by Mr. W. J. Chadburn, Chairman of the Electric Lighting Committee, and the other by the Mayor (Mr. T. Taylor). Mr. Chadburn, in the course of a statement, gave some interesting particulars with reference to the works, which, he said, would be constructed on the most up-to-date principle. The plant would consist of three 300-horse power steam-engines and dynamos combined, each capable of supplying 7000 lamps, or from 10 to 15 tramway cars, at one time; and, in addition, there would be a storage battery to provide electricity during the hours when the load required was small. The capacity of the site would allow for extensions and the erection of other municipal buildings. It adjoins the gas-works, which were visited last Saturday by the members of the Manchester District Institution of Gas Engineers. The work is being done under the supervision of Mr. R. Hammond.

The Smoke Nuisance at Torquay.

The action taken against the Torquay Corporation in connection with the smoke nuisance at the electric light works has convinced the Electric Lighting Committee that a new site will have to be found; and it was announced at the Council meeting yesterday week that the Committee are looking about for one. Probably the search will prove a long job, for in a town like Torquay no one wants works of this description for a neighbour, as the Corporation have already found out, not only as regards the electricity station, but in connection with that other modern improvement, the refuse destructor. Both the electricity works and the destructor have proved a source of annoyance in the neighbourhoods in which they have been established. As regards the electricity works, the proceedings taken by the Torbay Yacht Club have, no doubt, been partly responsible for the conversion of the Committee to the view that removal is necessary. It is true that the club agreed to withdraw the summons on the Corporation agreeing to pay the costs, and showing that they are doing all they can to avoid creating a nuisance; but it is quite clear that the works ought not to be in a position where, if anything goes wrong with the stoking, the fact is advertised in the most unpleasant fashion to half the town.

Birmingham's Electric Light Scheme.

Mr. E. A. Sandford Fawcett, an Inspector of the Local Government Board, held an inquiry at the Council House, Birmingham, last Tuesday, into an application by the Corporation to borrow £251,974 for the purposes of their electric light supply. The Town Clerk (Mr. E. O. Smith) explained the scheme in detail. He said that by a clause in the Birmingham Corporation Act of 1899 they were, with the consent of the Local Government Board, entitled to borrow, in addition to the £500,000 named in the Act, such further sums as they might require for the purposes of their electric supply. The sum mentioned had been expended mainly in the purchase of an undertaking from the British Electric Supply Company, and in developing existing works. The present application was for money for extending the undertaking. The amount proposed to be spent upon machinery, new buildings, and additions to existing power stations was £41,909, and the erection of the new generating station was set down at £128,890. The estimated cost of laying new mains, erecting and equipping a subsidiary station,

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providing meters, &c., was £58,000. With regard to the present generating stations, it was anticipated that they would be working at their full capacity in 1903. There was not sufficient land at the stations for any extension of the works. A new site would be purchased which contained about 2600 square yards, at a price of 15s. a yard. Mr. Smith next referred to the period to be allowed for the repayment of the loan. For the purchase-money for the land (£25,174) he asked sixty years; for the money for the erection of buildings, the architects' commission, &c. (£73,946), thirty years; and for that to buy the machinery and apparatus (£152,854), twenty years. Of course, the Corporation wanted as long a period as the Local Government Board would grant them. Mr. J. C. Vaudrey, the City Electrical Engineer, then gave evidence in respect of the scheme, which was followed by other testimony in respect to technical details.

Small Profits and Leaky Meters at Dudley.

At the last meeting of the Dudley Town Council, Alderman Dunn made a statement in reference to the working of the electric light undertaking during the past twelve months. He remarked that they had been very much deceived in the meters used throughout the borough, the result of the working of which had been that a very large quantity of electricity had been supplied for private lighting for which they had had no returns, and the Company furnishing the meters would have to make good the loss, which was put at £636. The estimated revenue for the twelve months ended the 31st of March had been £6117; the estimated total on the credit side of the accounts, £6816. The expenditure had been £6648. Deducting this from the gross estimated receipts, there was a net profit, after paying interest and sinking fund, of £168. The selling price of the electricity had only averaged 1½d per Board of Trade unit. He was quite convinced that the town would ultimately derive a tremendous benefit from the electricity undertaking. Mr. Bean did not think they were entitled to take credit for £636 in respect of the claim for the loss with the meters, as the question might involve expensive litigation. He thought the more reasonable course was to put down a deficiency of £400 on the year's working, which, considering that it was a new undertaking, was a result of which they need not be ashamed. Alderman Dunn said the amount which had been estimated as recoverable in respect of the loss with the meters did not amount to half of the actual claim; and, in his opinion, the profit had been under-estimated. He added that the meters were recommended by the Board of Trade, and no blame could be attached to either the Committee or the Engineer in the matter. Replying to inquiries, the Town Clerk (Mr. Brettell) said that £41,500 of the capital in connection with the electrical undertaking had been expended, and sanction had been given for the borrowing of further money amounting to £23,000—making a total of £64,500.

Electric Light and Gas in Competition in Devonport.

The Devonport municipal electricity works, which have for some months past been supplying current for tramway purposes, were formally opened on the 28th ult., and declared fit for undertaking the business of lighting for which they were primarily designed. As it now exists, the undertaking has cost £78,750, of which £15,000 was paid for the site of the generating station. The plant is capable of lighting 45,000 lamps of 8-candle power. For the present the only public lighting to be undertaken is that of Fore Street, Devonport—the main thoroughfare to the Dockyard—in which 16 arc lamps have been erected. It is a little unfortunate for the electricity undertaking that since the scheme was promoted the Corporation have acquired the gas-works. Originally there was an idea of displacing the gas-lamps in all the streets in the centre of the town; but this has now been cut down to the minimum, and how far it will be revived seems to depend upon the manner in which the gas-works succeed in holding their own in the competition. Mr. G. H. Smith, the Chairman of the Electricity Committee, stated at the opening of the works that in the lighting of the streets the Corporation would be guided by the result of the experiment about to be commenced. If it could be shown, as he believed it could, that the price of electricity compared favourably with that of gas, he believed there would be a demand for the light in other thoroughfares. It remains to be seen what answer the Gas Committee, who have just taken control of the gas-works, make to this challenge. In another direction Mr. Smith touted for custom without any reference to the question of comparative cost. The Devonport Corporation have taken over the Stonehouse Electric Light Order, and, having built their works in Stonehouse, they are anxious to develop business in that quarter. The streets are lighted by incandescent gas-lamps supplied by the Plymouth Gas Company; but Mr. Smith wants the District Council to go in for an electric lighting scheme, and the shopkeepers and others to adopt electric lighting, which apparently they are in no hurry to do.

The Bath Corporation and their Electric Light Works.

In the Council Chamber of the Bath Guildhall on the 1st inst., Mr. R. H. Bicknell, one of the Local Government Board Inspectors, held an inquiry into the application of the Corporation for power to borrow £25,000 for the electric light works. It was explained that, while £13,000 was needed for new plant to extend and improve the works, £12,000 had already been spent. Mr. J. A. Simon, who represented the Corporation, said the amount was made up of sums expended in extensions to meet the growth of the business. He admitted, in answer to the Inspector, that they dated back since April, 1899, and said the application would have been made earlier but for a change of engineers and the unfortunate breakdowns of last autumn. As to the £13,000, the new plant was absolutely necessary in order to meet the increased demands that would have to be met next winter. Mr. F. Teague, the City Electrical Engineer, said the new plant would carry them over next, and probably the following, winter. He expected that 8000 or 9000 new lamps would be connected this year, unless some calamity happened in the city which would set it back. He estimated that they lost £700 in the Christmas quarter by people using gas instead of electric light, in consequence of the breakdowns; but they did not affect the influx of new customers. They now had 37,000 lamps connected up; and if they all had to be alight at the same time, it would

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KINGSTON, PA.	125,000
PETERBOROUGH, ONT.	250,000
WILKESBARRE, PA.	750,000
ST. CATHERINES (Second Contract)	250,000
BUFFALO, N.Y.	2,000,000
WINNIPEG, MAN.	500,000
COLCHESTER (Second Contract)	300,000
YORK	750,000
ROCHESTER	500,000
KINGSTON, ONT.	300,000
CRYSTAL PALACE DISTRICT	2,000,000
DULUTH, MINN.	300,000
CATERHAM	150,000
LEICESTER	2,000,000
ENSCHEDE (HOLLAND)	150,000
BUENOS AYRES (RIVER PLATE CO.)	700,000
BURNLEY	1,500,000
KINGSTON-ON-THAMES	1,750,000
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SALTLEY, BIRMINGHAM (Third Contract)	2,000,000
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be impossible to supply them, as the total capacity of the plant now was for 33,000 lamps, and the new plant would supply another 16,500. Mr. E. Manville said he was entirely satisfied with regard to the figures in the estimate. Mr. W. Jeffery produced a resolution of the Bath Chamber of Commerce supporting the scheme. Mr. W. Evans and Mr. W. A. Phillips, who are both connected with the Ratepayers' Protection Association, opposed the application. They contended that the works were a financial failure, and that it would be unwise to spend further money on them. Mr. Evans described the undertaking as bankrupt. Mr. Simon said the Tramways Company had offered to acquire the entire undertaking. During the last financial year, after providing for sinking fund and interest, there was a profit on the works of £800—a fact disposing of the allegation as to its bankrupt state.

SHEPTON MALLET WATER SUPPLY.

The District Council and the Water-Works.

For some time past a movement has been in progress in favour of the purchase by the town of Shepton Mallet of the undertaking of the Water Company. The preliminary negotiations have been carried on between the District Council and the Company in a perfectly friendly manner; and it is believed that an amicable arrangement will be come to, whereby heavy law costs will be avoided. At the meeting of the Council last Tuesday, the Water Committee presented a report in which they stated that, having further considered the proposed acquisition of the water undertaking, they recommended that a request be made to the Water Company to submit an offer to the Council upon the following terms: (1) That a water engineer, to be named by the Water Company and approved by the Council, be instructed to investigate the undertaking—not as a partisan expert, but as a sole arbitrator between both parties—and put upon it such a valuation as an arbitrator would put. (2) That an accountant be appointed by the Company, and approved by the Council, to prepare a statement of account for the engineer, showing the back-dividends, overspent capital, &c. (3) That the amount fixed by the engineer shall be the price at which the Company shall offer the undertaking to the Council. (4) That the Company's solicitors' costs in advising the Company, together with the fees of the engineer and accountant, not exceeding a total of £150, shall be paid by the Council in any case, except only in the event of the Company refusing to sell at the amount fixed by the engineer. (5) That the engineer's report shall be without prejudice to either party; and the engineer shall not be employed by either side in the case of further action. (6) That the engineer be instructed to add 10 per cent. to his net valuation of the undertaking, as compensation for disturbance. (7) That the report of the engineer shall consist of a valuation showing the valuation placed upon the various assets of the Company, 10 per cent. thereon, the amount to be added for back-dividends, overspent capital, &c., the compensation due to the respective officers, the sum estimated to be required to place the undertaking upon a satisfactory basis, and a full report on the defects and requirements of the undertaking. (8) That the instructions of the Company to the engineer to proceed with his report and valuation shall be submitted to the Council. Before his appointment, the engineer shall be supplied by the Company with a copy of this report as finally adopted. (9) That the Council shall have a period of three months in which to accept or refuse the Company's offer. (10) That the report and valuation in full detail shall be the property of the Council on their becoming the purchasers of the undertaking in the mode provided for by the report. (11) That rules regulating the procedure before the engineer, submission of evidence, &c., to him, be drawn up and approved by both parties. (12) If the Company's offer is accepted by the Council, a formal agreement for the purchase shall be entered into; the agreement being conditional upon the Council obtaining, as soon as possible thereafter, an Act of Parliament incorporating the agreement and the repayment of the purchase-money during a period of not less than 50 years. This Act the Company shall not oppose. (13) All costs of the Company incidental to the above-mentioned agreement and the purchase of the undertaking to be borne by the Council.

NORTHAMPTON WATER SUPPLY.

Engineer's Annual Report.

The second annual report of Mr. Frank Tomlinson, the Water Engineer under the Corporation, has just been issued. In it Mr. Tomlinson states that up to the 25th of March he was not aware of a single case of direct pollution connected with the water supply either at Ravensthorpe or in the town. Not one complaint had been received during the year from the Medical Officer of Health as to the quality of the water. The total number of premises supplied with water was 19,235, of which 1021 were by meter. There were 342 new supplies in the year—the smallest number in the previous eleven years, for which figures were given. The total quantity of water supplied was 507,581,000 gallons, of which Ravensthorpe furnished 367,526,000 gallons, and the Billing Road well 140,055,000 gallons. This was an average daily supply of 1,390,000 gallons, which, taking the population at 88,000, amounted to 15·8 gallons per head per day. In his previous report, Mr. Tomlinson stated that the Billing Road well was capable of giving 680,000 gallons a day. Since then, however, he had prepared a series of diagrams showing the yield and pumping from 1887, and he was now of opinion that the well could not be relied upon to give more than 400,000 gallons a day over an extended period under present conditions. This being so, the available water supply at the present was 1,650,000 gallons per day—a surplus of 260,000 gallons per day over the consumption. Under these circumstances, Mr. Tomlinson impressed upon the Water Committee the necessity for economizing the present supply. There was a large quantity of water in the borough, he

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added, which, though not sufficiently pure to be utilized for domestic supply, might be employed for street-watering and sewer-flushing purposes. To use this water, duplicate mains and plant would be required; but he was confident that it could be sold at a profit at much less than 1s. 6d. per 1000 gallons, which was at least the value of the present supply. The quantity of water used for street flushing was 3,693,000 gallons, or a daily average of 26,556 gallons, equal at the present rate to a supply to a population of 1680 persons. During the year, 3537 yards of new mains were laid; 936 leakages were discovered; and 150 baths, closets, &c., were found in use without payment of rental.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Monday afternoon was very usefully spent by the Edinburgh and Leith Gas Commissioners in visiting their new gas-works at Granton. Though the Works Sub-Committee have been there frequently, the Commissioners as a body have not been in the new works since June 24 last. Since then very much has been accomplished. In fact, it may be said that the works are all but completed. Gas might be made in them in a week or two; but I believe it is not the intention to bring them into use till the autumn, which will be to the advantage of the structures. The finishing touches are being given to the retort-house, which is now an object of interest to anyone who has a knowledge of gas-making appliances. The retort-bench is a beautiful piece of work. Now, when it has been cleared of the litter of building material and the trammels of contractors' plant, its mass and symmetry are strikingly apparent. There is a sense of proportion about the whole house, which is instinctively felt; but the bench, with its equipment, compels observation and admiration as well. It is quite safe to describe it as the most complete "instrument" for the production of gas that there is in existence. The bench has been fitted with Mr. Herring's patent hydraulic appliance for opening and closing the sliding doors at top and bottom of the chambers which measure the coal for each charge. Along the centre of the charging-stage is a row of upright iron stands, with small levers at the top, by moving one of which the space of about an inch, the power is applied, and the slides move noiselessly to and fro. The operation can be done with the little finger. It will be remembered that, at the meeting of the North British Association of Gas Managers in Edinburgh in 1900, Mr. Herring read a paper upon the construction and working of inclined retorts, and exhibited diagrams illustrative of the Granton works. These showed the coal discharging into suspended waggons below the drawing-stage. This method of removing the coke has been dropped; and a conveyor has been put in instead. The conveyor passes out by the north end of the retort-house, crosses a portion of the yard (the coke being quenched on the way), and delivers into an iron chamber in which the coke is seized, and from which it drops into railway waggons for removal and sale, or, in the case of the breeze, for conveyance to the briquette-making machinery. All the underground work has been completed, about the last item of which was the tar-well, from which the contents will flow, by gravitation, to the chemical works at the seaside. There is still some fitting up to be done in connection with the scrubbing plant, the purifiers are not quite finished, and the two station meters which are being erected have not their drums completed. All the rest of the plant is as it will be when the works are going. The new gasholder is already in use, and is working splendidly. It is at present down for the purpose of being painted. In a district inhabited by people of highly æsthetic tastes, the selection of the colour to be given the holder was a matter of some moment. The ordinary red lead colour would have made the holder a somewhat too obtrusive object in the landscape. There were complaints last summer that it spoiled the view of Edinburgh from Fife; and at Liverpool recently the Earl of Rosebery spoke disparagingly of the "great towers of Babel" which the Gas Commissioners are erecting. His Lordship will be unable to greet the rising sun from the windows of his residences at Dalmeny and Barnhougle, without having the consciousness of a huge gasholder in the line of vision. Mr. Herring has had compassion on all who have tender susceptibilities in this respect, and has chosen a colour which will make the unpleasantness as small as possible. The one selected is a buff stone colour. When the Commissioners were there, the paint was being applied in three or four places by means of "Lightning" painters. The work is being done by the Commissioners' own men.

The Commissioners walked through the works in the route which has come to be recognized as the regulation one—beginning with the railway station, and finishing up with the chemical works. In passing through the place, it could not fail to be observed that outwardly there is a growing air of completeness. Slopes are being trimmed, and the surface levelled and sown with grass, giving a foretaste of the comfort and the pleasure which the possessors will have in their new surroundings. I must not omit to mention that the Granton Gas-Works are the only works of any magnitude which have been completed in the Edinburgh district, within the memory of man, without having greatly exceeded the estimated cost. The cost of the works is, of course, not yet known; but a Commissioner assures me that it will be very near the estimate, and may probably be below it. He is proud of this state of matters; and his sentiment will receive a general echo. The result is eloquent of the ability and the care with which the works have been planned, and their erection superintended.

The Corporation of Dumfries are not moving very fast in the matter of putting a provision for the storage of gas upon a satisfactory footing; but they took a step last week which shows that they are not altogether at a standstill. The Manager (Mr. G. Malam), in the beginning of February, recommended the construction of a new gasholder of 500,000 cubic feet capacity, adapted for telescoping so as to increase its capacity to 750,000 cubic feet; the estimated cost of the holder in its smaller size to be £8000. At present, there is only storage for 250,000 cubic feet; and as the maximum day's output of gas is 455,000 cubic feet, it will be seen that there is great need for more

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storage. But the Corporation are about to expend £18,000 upon electric lighting; and while not grudging this outlay, they do grudge expenditure upon the gas-works. A second report was asked for, and in it Mr. Malam stated that for a 500,000 cubic feet holder the cost, with a steel tank, would be £7753, with, in addition, £600 or £700 for excavation. With a brick tank, the cost would be £7478. He suggested that tenders should be taken for both brick and steel tanks. In the Council, Mr. Thomson, who is the leader of the opposition, argued that a holder of 250,000 cubic feet capacity would, with the existing storage, be sufficient. Mr. Currie, the Convener of the Gas Committee, said the present holder was rotten; and the Manager did not know when it might collapse. Should this happen, they would not have storage for even half a day. The Council agreed to take estimates for both the larger and the smaller holder.

It appears that the Auditor of the Dumfries Corporation accounts has raised objection to the allowance of discount to large consumers of gas; and the Town Council have resolved to obtain the opinion of Counsel upon the legality of the practice. The question is one which has a wide bearing. At the same time, it need not have been raised. I suppose it is due to the action of an over-zealous official. It is felt that auditors have statutory powers which, when exercised with strictness, make life upon public boards very unpleasant.

Ex-Provost Lennox, of Dumfries, and his wife have just celebrated their golden wedding; and in a notice of his career which appeared in a local newspaper the other day, an incident is mentioned which most likely is not remembered by many readers of the "JOURNAL." It says: "Most conspicuous was the part which he took in the overhauling of the gas-works after they had been acquired by the town. The transference from the old Company took place in 1878, the persistent pioneer of the movement being the late Dr. Wood. Hopes of immediate profit were disappointed; and it was found that on the first year's working the Corporation—burdened, as the Company had not been, by payment of interest on a large capital—had incurred a loss of £1006. The prospect was an alarming one; and several councillors, conspicuous among whom were Mr. Lennox and the late Bailie Paterson, set themselves vigorously to work to discover the cause and devise a remedy. These gentlemen, in company with the late Mr. A. Malam, the Manager, visited a number of towns for the purpose of examining the gas plant and obtaining information on the subject; and Mr. Lennox extended his personal inquiries to Newcastle, Gateshead, and Galashiels. The result was to convince them that a radical defect at the Dumfries works was the use of too long retorts, these being 11 feet odd, instead of 9 ft. 3 in. Replacing them with new retorts of the standard length, which required shorter firing, a great loss of gas was at once arrested; and the produce per ton of coal went up from 5371 to 11,000 cubic feet. Worn-out pipes were also lifted and replaced, and economy was effected in the coal contracts. Thereupon the tide turned, and began to set strongly in the direction of prosperity. The second year of the Corporation's management wiped out the first year's £1000 deficit, and realized a clear profit balance of £792. The price of gas, which in days of the Company stood at 5s. 10d. per 1000 cubic feet, was reduced at the end of the second year to 5s. Subsequent reductions brought it to 3s. 9d. during Mr. Lennox's provostship; and it has subsequently fallen to 3s. 6d., but was increased last year, for temporary reasons, to 3s. 8d."

There is a paragraph in the "Dundee Courier" to-day which says: "The question of the increases in the gas bill of Perth citizens was up before the Perth Town Council in Committee on Thursday, and occupied the attention of the councillors for considerably over a couple of hours. Councillor Macpherson, it appears, has sent a letter to the Gas Convener asking an explanation of the large increases. This led to a prolonged discussion; but, notwithstanding, the Committee failed to come to any definite decision. . . . We understand that it has been resolved that Mr. Newbigging, of Manchester, should be called in to make an examination and report on the matter." This is about the strangest remit I ever heard of.

The Town Council of the small town of Newburgh, in Fifeshire, are considering as to providing electric current for the lighting of the place. There is a population of 2000 persons, and the gas-works in the town have an annual output of 1,260,000 cubic feet; so that the Corporation seem to have an exaggerated notion as to the importance of their locality. They have obtained a report from an electrical engineer, which is to the effect that the proposed water power would not be sufficient, but suggesting that the gas-works could be utilized for a power station for low-grade gas, by means of which electricity could be generated, and the cost of lighting would be half what it is at present. Moreover, the gas could be also used for heating. It is said that the question was left over. I should think it extremely likely it would be. The Corporation do not as yet own the gas-works; and I presume that the experiment of taking over a coal-gas undertaking for the purpose of suppressing it and starting another manufacture in its place, will require to be tackled by bolder spirits than are to be found in what is little more than a village.

Gas Profits at Wigan.—At the meeting of the Wigan Town Council last Wednesday, Alderman Holmes, in moving the confirmation of the minutes of the Gas Committee, said he did not propose to make any remarks on the work of the past year, because the report of the Engineer (Mr. J. Timmins) had not been printed and circulated. He had only to say that the sum of £5550 had been handed over out of the gas profits in aid of the general district rate.

Sales of Stocks and Shares.—At the Mart, Tokenhouse Yard, E.C., last Tuesday, Mr. Alfred Richards sold, by order of the Directors, a new issue of ordinary £10 (5 per cent.) shares in the Southend Water Company, at prices ranging from £10 15s. to £11 2s. 6d. each; and a new issue of ordinary £5 shares (7 per cent.) in the Pinner Gas Company at from £5 10s. to £5 15s. per share. On the same occasion, he sold a few £10 ordinary shares in the West Ham Gas Company (last dividend 6½ per cent.) at £14 apiece. Messrs. Frank Lloyd and Sons recently sold some £10 shares in the Wrexham Gas Company at £14 each, and similar shares in the Wrexham Water Company at £16 each.

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LIVERPOOL, *May* 10.

Sulphate of Ammonia.

The week opened with a firm market, and, later, a further incitement to purchasing was given when the April shipments were known to show an increase of about 11,000 tons for January-April over the shipments for January-April, 1901—that is, an increase of about 20 per cent. At the close, there is a very strong demand, and quotations are £12 15s. per ton f.o.b. Hull, and £12 10s. per ton f.o.b. Leith and Liverpool. Even buyers abroad have realized the situation, and have begun to send orders at full market prices, for immediate delivery—indicating that requirements for the Spring season are by no means yet satisfied. The firm spot market has had the effect of stiffening makers' ideas in regard to forward delivery; but buyers, being mainly concerned about May and June delivery, have not responded to the advance demanded for delivery further ahead. For July-October, however, £11 17s. 6d. per ton has been paid f.o.s. Glasgow.

Nitrate of Soda.

Arrangements having been made for dealing with the stocks of this article thrown upon the market by the recent failure in Hamburg, the market has assumed a firmer tone at the Continental ports. Moreover, there has been a much improved Continental demand within the past ten days, and May deliveries give promise of very considerably exceeding those for May, 1901. The spot prices are 9s. 6d. and 9s. 7½d. per cwt. for ordinary and refined qualities, respectively.

LONDON, *May* 10.

Tar Products.

Pitch continues remarkably firm, and a considerable business is reported to have been done for January-June, 1903. In fact, there are already inquiries in the market for July-December, 1903; and in some instances quotations have been asked for up to the end of 1904. There are no stocks anywhere; while the demand for asphalting and tramway purposes is very strong indeed. Carbolic is in the same position. There is no fresh business to report, except a small sale by London distillers at slightly over 1s. 11d. for early delivery. Crystals are very quiet, and there is nothing fresh to report. Benzol shows signs of improvement. Early in the week, a sale was reported of 5000 gallons at 8¾d. f.o.b. London; but consumers will not continue purchasing at this price, and do not seem inclined to contract up to the end of the year. Solvent is still very depressed; and there is only a limited demand for home consumption. As regards toluol, business is reported in best quality, pure, for July-December delivery. Creosote continues quiet, especially in the North, where the market is decidedly easier—manufacturers now showing more disposition to sell forward. As regards anthracene, the position remains unchanged.

The average values during the week were: Tar, 16s. to 21s. Pitch, London, 42s. 6d. to 43s.; east coast, 41s. to 41s. 6d.; west coast, 37s. 6d. to 38s. Benzol, 90 per cent., 8¼d. to 8¾d.; 50-90 per cent., 7½d. to 7¾d. Toluol, 9d. Crude naphtha, 3d.; solvent naphtha, 9d. to 9½d.; heavy naphtha, 9d. to 10d. Creosote, London, 1¼d.; North, 1d. Heavy oils, 1⅞d. to 2d. Carbolic acid, 60 per cent., 1s. 11d. Naphthalene, 35s. to 50s.; salts, 21s. 6d. to 25s. Anthracene, "A," 1½d. to 1¾d.; "B," 1d. nominal.

Sulphate of Ammonia.

The market continues to improve. The Gaslight and Coke Company now ask £12 per ton for July-September, but would accept £11 12s. 6d for October-December. They appear to have nothing to offer for May or June. It is reported that one London Gas Company realized £12 2s. 6d. for prompt shipment, Beckton terms; but there is very little offering from London in any quarter. The demand continues strong from Leith for both prompt and forward delivery; and prices are decidedly firmer. In Hull, the demand does not seem to be quite so good as at other ports; but £12 2s. 6d. has been paid in one or two instances for May-June shipment. In Liverpool, there is a very strong demand for prompt shipment, and £12 7s. 6d. has been paid in more than one instance; while for May-June business has been arranged at £12 6s. 3d.

COAL TRADE REPORTS.

Lancashire Coal Trade.

Although for the most part a fairly steady business is being maintained as regards business, the tendency of prices, so far as round coals are concerned, is in a weakening direction. On house-fire qualities, the reduction of about 10d. to 1s. 3d. per ton has become general. For the present, collieries are moving away their output fairly well, owing to orders now being executed which were held back last month, and also to the recent spell of colder weather bringing forward some increased requests for domestic consumption. Pits, however, are in many cases not running full time; stoppages being resorted to rather than allow stocks to accumulate in any great weight. In the lower qualities of round coal, the position with regard to prices is weak and irregular. The demand for iron-making, steam, and general manufacturing purposes, is indifferent; and with supplies plentiful, low rates are ruling—these being in many cases regulated according to the competition in the market, and the quantity buyers are prepared to take. Although there has been no actual official reduction, prices have given way fully 1s. to 1s. 6d. per ton on the maximum nominal list rates; and it is exceptional where more than about 8s. 6d. at the pit, is being obtained for ordinary steam and forge coals. For gas coals, further contracts have been settled on much the same basis as previously reported, representing about 1s. below last year for the best qualities, and 1s. 6d. on some of the inferior sorts. This brings the basis to about 9s. at the pit for common gas coals, up to 10s. and 10s. 3d. for better qualities. The railway companies are still hanging back from sett'ing

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locomotive fuel contracts, as the principal Lancashire collieries are declining to come down to the 8s. basis. One or two comparatively small contracts have been placed at this figure in Lancashire; and it is reported the railway companies are buying fairly large quantities in Derbyshire under even this price. The leading Lancashire colliery owners are still holding out for 8s. 6d.; but the railway companies are returning tenders for revision where this basis is quoted. The shipping trade remains only quiet, and prices vary a good deal according to the surplus here and there hanging at collieries; but from 9s. 6d. to 10s. may be taken as the average figures, delivered at the ports on the Mersey. The engine fuel trade, on the other hand, is showing some slight improvement, so far as the best qualities of slack are concerned. The general reports during the past week have been that collieries have had more inquiry for this description of fuel, and have experienced no difficulty in maintaining full rates—slight advances even being quoted in some instances. Common sorts, however, remain plentiful; and, with continued keen competition from outside districts, prices are kept low. At the pit, best Lancashire slacks average 6s. 6d. to 7s. per ton, and common 4s. 6d. to 5s., with all sorts of prices taken for slack in the Derbyshire district. For coke, a steady demand comes forward, both throughout Lancashire and Yorkshire; and not only is there no difficulty in maintaining prices, but in some of the Yorkshire districts there is a tendency to stiffen. Quotations may be given at about 22s. to 24s. for best Lancashire foundry, 13s. 6d. to 14s. for best furnace cokes, 13s. 6d. for best Yorkshire furnace, and 11s. 6d. to 12s. for common furnace cokes, at the ovens.

Northern Coal Trade.

Now that the Cronstadt season has begun, the coal trade finds the impetus of that increased demand usual at this time of the year. Steam coal is much more active, and the price is firmer; best Northumbrian steam coals being from 11s. to 11s. 6d. per ton f.o.b. Second-class steams are more irregular, but may be quoted at from 10s. to 10s. 6d., and steam smalls are not quite so scarce, and are from 5s. 6d. to 6s. The gas coal trade is relieved by the settlement of the heavy contracts for the Metropolis; and these generally fix values as based on about 8s. 9d. to 9s. per ton for good Durham gas coals, though for certain qualities slightly varying quotations are made. One or two large local contracts are now in the market. Best Durham coke for export is 17s. to 17s. 6d. per ton f.o.b., blast-furnace coke is from 15s. 3d. to 15s. 6d. at the Teesside works, and gas coke is still rather plentiful and irregular in price. The contracts for coal for the Newcastle Gas Company have been settled for another year from June. The price is from 8s. 7½d. to 8s. 10½d. per ton, and the quantity about 280,000 tons.

Scotch Coal Trade.

Trade has been quiet, with prices tending downwards. The demand has been so slack that in some instances pits have been closed for a day or two for want of orders. There is an improvement in shipping. The prices quoted are: Main 8s. 3d. to 8s. 6d. per ton f.o.b. Glasgow, ell 9s. 6d. to 10s. 3d., and splint 9s. 6d. to 9s. 9d. The shipments for the week amounted to 224,260 tons—an increase of 29,249 tons upon the previous week, and of 13,409 tons upon the corresponding week of last year. For the year to date, the total shipments have been 3,149,429 tons—an increase of 280,118 tons upon the same period of the previous year.

The Bristol Water Company's New Works.—In accordance with a promise made by Mr. Charles Hawksley in his Inaugural Address at the opening of the session of the Institution of Civil Engineers last November, he on Thursday conducted a large party, composed of students of the Institution and a number of other gentlemen, including the Directors of the Bristol Water Company, over their new pumping-station at Blagdon. There are four powerful engines, each capable of lifting 2 million gallons of water per day; and the steam for them is generated in six boilers of the most modern type. After luncheon had been partaken of, the visitors saw the engines brought into action.

Loss on the Darwen Gas-Works.—At the meeting of the Darwen Town Council on Monday last week, Mr. Carus, in moving the adoption of the minutes of the Gas Committee, said there had been a loss of £3800 on the year's working. The cause of this was a slump in residuals. Coke twelve months ago stood at 15s. 6d.; to-day it was selling at 8s. 4d. It had been decided to raise the price of gas 3d. per 1000 cubic feet, to commence on the 1st of July. This was absolutely necessary, if they were to meet their expenditure. Mr. Davies moved that the recommendation with regard to the increase in the price of gas should be referred back, as he would like to have the figures gone through carefully. Mr. Ashton seconded the amendment. It was decided to refer back for a month the question of raising the price of gas.

The Geltsdale (Carlisle) Water Scheme.—The resolution which was passed by the Geltsdale Water Committee of the Corporation when they decided to ask Mr. Mansfield to advise them generally as to the Geltsdale water scheme was as follows: "That the Council be recommended to retain Mr. James Mansergh, M.Inst.C.E., of Westminster, to report (1) fully upon the Geltsdale scheme, and particularly upon the watershed as a suitable source of supply for the city, the quantity and quality of the water, and the proposals for obtaining, storing, and conveying the water to the city, as contained in the Carlisle Corporation Water Act, 1898, the suitability or otherwise of the reservoir site, and the probable total cost of construction of the works; and (2) the position of the city with regard to its present water supply, and his recommendations for extension and improvement, and the probable total cost thereof."

The London County Council and Gas and Meter Testing.—At the meeting of the London County Council last Tuesday, the Public Control Committee presented their estimates for the year 1902-3. In the special county account, the expenses recoverable from Gas Companies for gas testing were put down at £200, although they only amounted to £165 last year. The fees for gas-meter testing were estimated at £6750; being an increase of £1130 over the actual receipts of 1901-2. The salaries of gas examiners, stores, and incidental expenses connected with gas-testing represented a total of £3985 against £3598; and a sum of £7880 was put down for the salaries and wages of inspectors and assistants, rent, rates, repairs, &c., of testing offices, stores, and incidental expenses—being £775 more than last year. The estimates were approved.

Messrs. Kirkham, Hulett, and Chandler, Limited, have received an order from the Shelley and Shepley Gas Company, Limited, for one of their patent "Standard" condensers; and also an order from the Bridport Gas Company for a patent "Standard" washer-scrubber.

At their meeting on Monday last week, the Exmouth Urban District Council resolved to borrow £67,533 from the Prudential Assurance Company to purchase the Exmouth and District Water Company's undertaking—the principal and interest to be repaid in 100 half-yearly instalments. It was also decided that a cheque should be drawn for £67,533 in favour of the Company.

Messrs. R. & A. Main, Limited, of Glasgow and Falkirk, have recently concluded successful gas exhibitions (combined with free cookery lectures) in the following towns: Dundee, with lectures by Miss E. M. Dods; Wishaw, with lectures by Miss M. Baines; Inverness (in conjunction with Messrs. Parkinson and Cowan), with lectures by Miss M'Vean; Ashton-under-Lyne, with lectures by Mrs. Gray.

Contracts for installations of coal elevators and conveyors, hot-coke conveyors, or settings of inclined retorts have been placed with the New Conveyor Company, Limited, Smethwick, by the Corporations of Manchester, Sheffield, Leeds, Glasgow, Middleton, Smethwick, Birmingham, and Bournemouth; also by the following: City and South London Railway Company; Mersey Railway Company; Wm. Beardmore and Co., Armour Plate Works, Glasgow; and the Cambridge University and Town Gas Company.

At the Watford Police Court, a few days ago, Mr. J. Brockwell, of 40, High Street, Bushey, was summoned, at the instance of the Colne Valley Water Company, for wasting water on the 23rd of April. Mr. J. K. Riggell, solicitor, who appeared for the Company, said defendant occupied one of three houses supplied by one pipe. In consequence of complaints from the other householders as to a shortage of water, an inspector of the Company visited defendant's premises, and saw waste going on from a tap in the scullery, and considerably more in the water-closet. Charles Hine, the inspector mentioned, deposed to visiting defendant's premises, and seeing the tap in the scullery running at full flow. He went to the closet, and saw a continuous flow of water into the pan. The tap wanted a washer, and could be repaired in ten minutes, at a cost of 1s. In the closet the ball tap was out of repair, and the chain had attached to it a 7-lb. weight. Witness made subsequent visits, but found the waste continuing. Ultimately he repaired the kitchen tap, and defendant promised to attend to the closet. The cost of repair would be 1s. in each instance. Defendant said he was under the impression that the landlord should carry out the repairs. Mr. W. Verini, Secretary to the Company, deposed to receiving complaints from defendant's neighbours, and to sending notices to Brockwell. The witness Hine, in reply to the Bench, said he estimated the waste at 200 gallons an hour. The Chairman said that when there were complaints as to the dearth of water this sort of waste was iniquitous. Defendant would be fined £3 and 7s. 6d. costs. The Magistrates hoped this case would be a caution to the public. In the next one of the kind, the full penalty would be inflicted.

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ARTHUR ROWLANDS,
Clerk to the Council.

Council Offices, Clwyd Street, Rhyl, May 7, 1902.

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THE Rhyl Urban District Council are prepared to receive TENDERS for the following GAS PLANT:—

1. WATER CONDENSERS with Connections.
2. LIVESEY WASHER with Connections.
3. TAR-SEPARATOR.

Full Particulars can be obtained from Mr. Leonard G. Hall, Assoc.M.Inst.C.E., Gas Engineer.

Sealed Tenders, endorsed "Tender for Gas Plant," to be delivered to the undersigned on or before Tuesday, the 27th of May, 1902.

Approved security will be required.

The Council do not bind themselves to accept the lowest or any Tender.

ARTHUR ROWLANDS,
Clerk to the Council.

Council Offices, Clwyd Street, Rhyl, May 7, 1902.

CITY OF LEEDS.
(GAS DEPARTMENT.)

THE Gas Committee of the above Corporation have FOR SALE the following Second-Hand Plant :—

28 Lengths of Wrought-Iron ⌂-shaped HYDRAULIC MAIN, 24 inches wide, and 24 inches deep.
180 DIP-PIPES, 6 inches diameter.
180 ARCH-PIPES.
100 ⌂ MOUTHPIECES, 20 in. by 14 in.
100 ASCENSION-PIPES.
8 SYPHON BOXES.
8 10-inch VALVES.
36 Cast-Iron STANDS.
WATER-CISTERN, composed of 42 plates 5 ft. 8 in. by 4 ft. 6 in. by ⅜ in. thick, with flanges 3¾ in. wide ; ¾-inch bolts.

For further Particulars, apply to the undersigned.

Tenders, addressed to the Chairman of the Gas Committee, and endorsed "Second-Hand Plant," to be delivered not later than Saturday, the 24th inst.

R. H. TOWNSLEY,
General Manager.

Gas Offices, Leeds,
May 9, 1902.

CITY OF LEEDS.
(GAS DEPARTMENT.)

TO IRONFOUNDERS.

THE Gas Committee of the Leeds Corporation are prepared to receive TENDERS for the Construction and Erection, at the Meadow Lane Gas-Works, of a CAST-IRON WATER-CISTERN for the Carburetted Water-Gas Plant.

Plan may be seen, and Specification and Bill of Quantities obtained, on application to the undersigned.

Tenders, endorsed "Water-Cistern," addressed to the Chairman of the Gas Committee, Municipal Buildings, Leeds, will be received not later than Saturday, the 24th inst.

The Committee do not bind themselves to accept the lowest or any Tender.

R. H. TOWNSLEY,
General Manager.

Gas Offices, Leeds,
May 1, 1902.

BOROUGH OF EVESHAM.
(GAS DEPARTMENT.)

TENDERS FOR GAS COAL.

THE Corporation invite Tenders for the supply of from 1000 to 2000 Tons of Best Screened GAS COAL, during the Year ending the 30th day of June, 1903, to be delivered on rail at Evesham.

Tenders, to be sent to me not later than the 30th day of May inst., to include full description and particulars as to coal and price.

No Form of Tender supplied.

The Corporation do not bind themselves to accept the lowest or any Tender.

THOS. A. COX,
Town Clerk.

Town Clerk's Offices,
Evesham, May 8, 1902.

BOROUGH OF RICHMOND, SURREY.
(WATER-WORKS.)

WATER-MAINS.

TENDERS are invited for the supply of 470 4-inch Cast-Iron SPIGOT and SOCKET PIPES, 9 feet lengths, to weigh 1¼ cwt. each Pipe, coated with Dr. Angus Smith's Composition, and delivered free of all charges at the Water-Works Wharf on the River Thames, or at the Railway Station, Richmond, Surrey.

Particulars and Forms of Tender can be obtained of Mr. W. G. Peirce, Engineer, at the Water-Works.

Tenders to be delivered at the Town Hall, Richmond, Surrey, by Ten a.m. on Monday, May 26, addressed to the Chairman of the Water Committee, and endorsed "Tender for Cast-Iron Pipes."

F. B. SENIOR,
Town Clerk.

Town Hall, Richmond,
Surrey, May 6, 1902.

BOROUGH OF RICHMOND, SURREY.
(WATER-WORKS AND PUBLIC BATHS.)

TENDERS FOR SMOKELESS WELSH STEAM COAL.

THE Town Council of the Borough of Richmond, Surrey, invite TENDERS for the supply of about 1500 Tons of best WELSH SMOKELESS STEAM COAL, to be delivered in Barges of about 40 Tons alongside the Wharf opposite the Water-Works, Richmond, for One Year from the 1st day of July 1902, to the 30th day of June, 1903.

The Seam and District from which the Coal is to be supplied must be stated in the Tender.

Particulars and Forms of Tender can be obtained of Mr. W. G. Peirce, Borough Water-Works Engineer, at the Water-Works.

No Tender will be recognized unless it is made on the prescribed Form, properly filled up in every respect, and no expenses or claim will be allowed or paid to any person whether tendering or not.

The security stipulated by the Public Health Act, 1875, for the due performance of the Contract will be required.

The Contract and Bond will be prepared by the Town Clerk.

Sealed Tenders, endorsed "Tender for Welsh Coal," and addressed to the Chairman of the Water Committee, Borough of Richmond, Surrey, must be delivered at the Town Clerk's Office, by Ten o'clock on Monday, the 26th of May, 1902.

The Council do not bind themselves to accept the lowest or any Tender.

FREDK. B. SENIOR,
Town Clerk.

Town Clerk's Office,
Town Hall, Richmond, Surrey,
May 6, 1902.

STOCKTON-ON-TEES CORPORATION.

RETORT-SETTINGS.

THE Gas Committee of the above Corporation are prepared to receive TENDERS for the Construction of ten beds of through RETORTS on the Regenerative Principle.

Particulars may be had on application to the undersigned.

WILLIAM FORD,
Manager.

Corporation Gas-Works,
Stockton-on-Tees.
May 9, 1902.

STOCKTON-ON-TEES CORPORATION.

TENDERS FOR GAS COAL.

THE Gas and Electricity Committee of the above Corporation invite TENDERS for the supply in whole or part of 40,000 Tons of GAS COAL for the Year ending March 31, 1903.

TENDERS, sealed and endorsed "Tenders for Gas Coal," to be sent in not later than noon of the 23rd day of May, 1902, addressed to the undersigned, at the Gas-Works, from whom Forms of Tender, &c., can be had.

The Gas and Electricity Committee do not bind themselves to accept the lowest or any Tender.

By order,
WILLIAM FORD,
Manager.

Corporation Gas-Works,
Stockton-on-Tees.

STOCKTON-ON-TEES CORPORATION.

METERS AND COOKERS.

THE Gas Committee of the above Corporation are prepared to receive TENDERS for the supply of the METERS and COOKERS that may be required by the Department during the Year ending March 31, 1903.

Particulars may be had on application to the undersigned.

Tenders, to be endorsed "Tender for Meters" or "Cookers."

WM. FORD,
Manager.

Corporation Gas-Works,
Stockton-on-Tees,
May 10, 1902.

KIDSGROVE GASLIGHT COMPANY.

GAS COALS.

THE Directors invite Tenders for the Supply of about 3000 Tons, to be delivered during the Twelve Months ending June 30, 1903, in such quantities as the Manager shall direct.

Tenders to be delivered on or before May 29, 1902.

The lowest or any Tender not necessarily accepted.

JAMES BEECH,
Manager and Secretary.

Kidsgrove, Staffs,
May 8, 1902.

TAR AND LIQUOR.

THE Directors invite Tenders for the Surplus TAR and LIQUOR produced at their Works during the Twelve Months ending June 30, 1903.

Tenders to be delivered on or before May 29, 1902.

The lowest or any Tender not necessarily accepted.

JAMES BEECH,
Manager and Secretary.

Kidsgrove, Staffs.
May 8, 1902.

RHONDDA URBAN DISTRICT COUNCIL.
(GAS AND WATER DEPARTMENT.)

THE above Council are prepared to receive TENDERS for the supply, delivery, and fixing of an EXHAUSTER, to pass 30,000 cubic feet of Gas per hour, at their Porth Gas-Works.

Specification may be seen, and Forms of Tender obtained, upon application to Mr. Octavius Thomas, Engineer and Manager, Gas and Water Offices, Pentre, R.S.O., Glam.

The Contractors will be required to pay the Standard Rate of Wages recognized in the District.

Tenders, endorsed "Contract No. 17," addressed to the Chairman of the Gas and Water Committee, to be sent to the undersigned on or before Ten a.m. on Thursday, the 22nd inst.

The Council do not bind themselves to accept the lowest or any Tender.

WALTER P. NICHOLAS,
Clerk.

Council Offices, Pentre, R.S.O., Glam.,
May 8, 1902.

MARKET HARBOROUGH URBAN DISTRICT COUNCIL.
(GAS DEPARTMENT.)

TENDERS FOR GAS COAL AND SULPHURIC ACID.

THE Gas Committee invite Tenders for :

GAS COAL.

The supply of the whole or part of 3700 Tons of Best Screened GAS COAL or NUTS, to be delivered as may be required during the Year ending June 30, 1903, at the Sidings of the London and North-Western or Midland Railway Station, Market Harborough.

SULPHURIC ACID.

The supply of SULPHURIC ACID, to be delivered in Sender's Carboys at Market Harborough Station as may be required during the Year ending June 30, 1903.

Conditions and form of Tender may be obtained from the undersigned, to whom sealed Tenders, endorsed "Coal" and "Sulphuric Acid" respectively, must be delivered not later than Saturday, the 24th day of May, 1902.

The lowest or any Tender not necessarily accepted.

A. T. HARRIS,
Manager and Secretary.

Gas Office : St. Mary's Road,
Market Harborough, May 8, 1902.

KNARESBOROUGH URBAN DISTRICT COUNCIL.
(GAS DEPARTMENT.)

TENDERS wanted for the Re-setting of TWO BEDS of ⌂ RETORTS (seven and four), providing all material. The Retorts to be Ingham's, of Leeds.

Tenders to be in by the 24th inst., and the work to be completed by the 14th of July.

T. MAINMAN,
Clerk.

CIRENCESTER GAS COMPANY, LIMITED.

TENDERS FOR GAS COAL.

THE Directors are prepared to receive TENDERS for the supply of 4000 Tons of GAS COAL during the Twelve Months commencing July 1 next.

Tenders, stating Price delivered to the Watermoor Station of the Mid. and South-Western Junction Railway Company, to be sent in by the 4th day of June next.

The Directors reserve the right to accept Tenders for Six Months only, if so desired.

J. P. BEECHAM,
Secretary.

12, Silver Street, Cirencester,
May 12, 1902.

COUNTY BOROUGH OF HALIFAX.

THE Gas-Works Committee of the Halifax Corporation invite TENDERS for the supply of 50,000 Tons of GAS COAL, to be supplied in such quantities as may from time to time be determined by the Gas-Works Committee during the Year ending the 30th of June, 1903.

Forms of Tender and further Information may be obtained on application to Mr. Thomas Holgate, M.Inst.C.E., Gas Engineer, Halifax.

Tenders, endorsed "Coal," must be sent to the undersigned not later than Ten o'clock a.m. on Wednesday, the 14th of May, 1902.

The Committee do not bind themselves to accept the lowest or any Tender.

By order,
KEIGHLEY WALTON,
Town Clerk.

BOROUGH OF DARWEN.

THE Corporation are prepared to receive TENDERS for all the surplus GAS TAR produced at their Gas-Works for one Year.

Also for the supply of the following Goods for One Year:—

1. VITRIOL.
2. BRASS FITTINGS.
3. PAINTS AND OILS.
4. WROUGHT-IRON TUBES AND FITTINGS.
5. CAST-IRON MAINS AND SPECIALS.
6. LEAD PIPE .

Particulars as to quantities may be obtained on application to Mr. A. H. Smith, Gas Engineer, Darwen.

Sealed and endorsed Tenders must be delivered to the undersigned at or before noon on Monday, May 26, 1902.

No Tender necessarily accepted.

By order,
WILLIAM P. HALLIWELL,
Town Clerk.

Town Clerk's Office,
May 8, 1902.

EXMOUTH GAS COMPANY.

TENDERS FOR GAS COAL.

THE Directors of the Exmouth Gas Company invite TENDERS for 5000 tons of clean Unscreened (through and through) first-class Durham or any other good GAS COAL, to be shipped in such quantities (by Sailing Vessels only) and at such times as may be required, commencing from the 1st of July next.

Tenders to be accompanied by practical working analysis, and prices may be quoted c.i.f. or f.o.b. at Exmouth Docks.

Sealed Tenders to be sent to the undersigned, addressed to the Chairman of the Company, and endorsed "Tender for Coal," not later than Saturday, the 31st day of May, 1902.

The Directors reserve to themselves the right to accept the whole or any portion of any quantity offered, and do not bind themselves to accept the lowest or any Tender (no special Form of Tender issued).

By order,
JAMES T. FOSTER,
Secretary and Manager.

Gas-Works, Exmouth,
May 9, 1902.

SOWERBY BRIDGE URBAN DISTRICT COUNCIL.
(GAS DEPARTMENT.)

TENDERS FOR CANNEL AND COAL.

THE Gas Committee are prepared to receive TENDERS for the supply and delivery of 1200 Tons of CANNEL and 14,200 Tons of Best Screened GAS COALS, or such quantity as may be required for the Gas-Works at Sowerby Bridge and Luddenden Foot during the period of Twelve Months between the 1st of June, 1902, and the 31st of May, 1903.

Tenders will be received for the whole or any portion of the above quantity.

Specifications and Forms of Tender, and all Information, can be obtained on application to the Engineer, Mr. A. W. Bissell, Gas-Works, Sowerby Bridge.

The Gas Committee reserve the right to accept Tenders for the whole or any portion of the quantity offered, and do not bind themselves to accept the lowest or any Tender.

Sealed Tenders, endorsed "Tender for Coal" or "Cannel," to be sent, not later than Monday morning, the 26th of May, 1902, to

GODFREY RHODES AND EVANS,
Clerks to the Council.

Commercial Bank Chambers,
Halifax, May 9, 1902.

TO COLLIERY PROPRIETORS AND OTHERS.

THE Directors of the Bodmin Gas Con-sumers' Company, Limited, invite TENDERS for the supply of about 1500 tons of best GAS COALS, to be delivered free at the London and South-Western Railway Company's siding adjoining the Works at Rodmin, in such quantities and at such times as may be required within the ensuing nine months.

Sealed and endorsed Tenders to be sent to the undersigned, not later than June 3 next.

JOHN PETHYBRIDGE,
Secretary.

Bodmin, May 2, 1902.

BOROUGH OF WORKINGTON.
(GAS DEPARTMENT.)

TENDERS are required for the supply of 10,000 Tons of best GAS COAL, to be delivered during the Twelve Months ending June 30, 1903.

Tender Forms and further Information will be furnished on application to the Manager, Mr. G. Keyte, Stanley Street, Workington.

Tenders to be sent in on or before Monday, May 19, 1902, addressed to the Chairman of the Gas Committee, Town Hall, Workington, endorsed "Tender for Coal."

The Corporation do not bind themselves to accept the lowest or any Tender.

By order,
JOHN WARWICK,
Town Clerk.

Town Hall, Workington,
May 7, 1902.

BOROUGH OF SMETHWICK.
(GAS DEPARTMENT.)

TAR CONTRACT.

THE Gas Committee invite Tenders for the purchase of the surplus TAR produced at their Gas-Works during the period of One, Two, or Three Years from the the 1st of October next.

Form of Tender and further Particulars can be obtained from the undersigned.

Tenders, endorsed "Tender for Tar," and addressed to the Chairman of the Gas Committee, to be delivered to me not later than the 28th of May next.

W. J. STURGES,
Secretary.

Gas Offices, Town Hall,
Smethwick, April 30, 1902.

THE Directors of the Witham Gaslight and Coke Company, Limited, invite TENDERS for not exceeding 1000 Tons of Screened GAS COAL, to be delivered at Witham Station between the 1st of July, 1902, and the 30th of June, 1903, in such quantities and at such times as may be required.

The Coal must be freshly wrought, clean, and free from Pyrites and Bats.

Tenders must state the Price per Ton delivered as above, and be sent to the undersigned on or before the 15th inst.

The Directors do not bind themselves to accept the lowest or any Tender.

No special Form of Tender supplied.

By order,
F. P. BAWTREE,
Secretary.

Witham, Essex,
May 1, 1902.

COUNTY BOROUGH OF HUDDERSFIELD.

TENDERS FOR GAS COAL AND NUTS.

THE Gas Committee are prepared to receive TENDERS, from Colliery Proprietors only, for the supply and delivery of about 60,000 Tons of unscreened GAS COAL and screened NUTS for a period of Twelve Months, commencing the 1st of July, 1902.

Full Particulars and Form of Tender may be obtained on application to the Gas Engineer and Manager, Leeds Road, Huddersfield.

Sealed Tenders, endorsed "Tender for Gas Coal," must be delivered free of charge, addressed in handwriting of the Tenderer or his Agent, to the Town Clerk, Town Hall, Huddersfield, not later than Thursday, the 22nd of May, 1902.

The Corporation do not bind themselves to accept the lowest or any Tender.

By order,
F. C. LLOYD,
Town Clerk.

Town Hall, Huddersfield,
May 8, 1902.

GLOUCESTER GASLIGHT COMPANY.

TENDERS FOR GAS COAL.

THE Directors of the above Company invite TENDERS for the supply of about 33,000 Tons of GAS COAL for One Year from the 1st day of July next, in such monthly quantities as may be required by the Company.

Tenders to state the price delivered at the Midland Railway Sidings, Hempsted, near Gloucester, or the Great Western Railway Wharf, Llanthony, Gloucester; or if sent (as preferred) by Water, the price f.o.b., and also the price delivered at the Gas Company's Wharf on the Gloucester and Berkeley Canal.

Further Particulars and Forms of Tender may be obtained of the undersigned.

Sealed Tenders, endorsed "Tender for Coal," specifying the description and quality of the Coal, to be addressed to the Chairman, Gas Offices, Eastgate Street, Gloucester, and delivered not later than Monday, the 2nd day of June next.

The Directors reserve to themselves the right to accept the whole or any portion of any quantity offered, and do not bind themselves to accept the lowest or any Tender.

By order,
WILLIAM E. VINSON,
Secretary.

Gas Offices, Gloucester,
May 1, 1902.

THE Thorney Gas Company invite TENDERS for the supply and laying of about 2200 yards of GAS-MAINS, in sizes from 3 inches to 6 inches in diameter, Valves, &c.

Plans and Specification may be seen at the Bedford Office, Thorney, Peterborough; and Tenders must be endorsed "Gas-Mains," and addressed to Arthur J. Forrest, Esq., at the said office, not later than the 31st inst.

Thorney, Peterborough,
May 8, 1902.

FARNWORTH AND KEARSLEY GAS COMPANY.

THE Directors of the Farnworth and Kearsley Gas Company are prepared to receive TENDERS for the surplus TAR produced at their Works for One Year.

Sealed Tenders, addressed to the Chairman, J. W. Watkinson, Esq., to be delivered on or before Wednesday, the 28th inst.

Form of Tender or any further Information required may be obtained from the undersigned.

THOMAS LEA SHEPPARD,
Manager.

THE Ware Gas Company, Limited, invite TENDERS for the supply of from 1500 to 2000 Tons of East Pontop, Barrow, Norfolk, or Strafford Silkstone or Aldwarke Main GAS COAL for the Year ending the 24th day of June, 1903.

Particulars may be obtained of the undersigned.

Sealed Tenders to be delivered to me on or before the 2nd day of June prox.

The lowest Tender will not necessarily be accepted.

Dated this 9th day of May, 1902.

GEO. H. GISBY,
Secretary.

Ware, Herts.

ILFORD GAS COMPANY.

THE Directors of the above Company invite TENDERS for the supply of 5000 tons of GAS COAL, delivered f.o.r. Ilford Station, G. E. Railway, or in barges f.a.s. the Company's Wharf on the River Roding.

Sealed Tenders, endorsed "Tender for Coal," addressed to the Chairman, to be sent to the undersigned not later than Monday, May 19, 1902, from whom any further Information can be obtained.

J. H. BROWN,
Engineer and Manager.

Gas Works, Ilford.
May 1, 1902.

COUNTY BOROUGH OF BLACKBURN.
(GAS DEPARTMENT.)

THE Gas Committee invite Tenders for the surplus TAR made at their Works during the Year ending the 30th of June 1903.

The estimated quantity is 3200 Tons; and Tenders are to state a price for same delivered into Tank-Waggons at the Greenbank Gas-Works Sidings, Blackburn.

Forms of Tender may be obtained from the undersigned, and to be delivered in sealed envelopes, endorsed "Tar," before Saturday, the 24th of May, 1902.

S. R. OGDEN,
Engineer and Manager.

Gas Department,
Municipal Offices,
Blackburn, May 8, 1902.

HERTFORD GASLIGHT COMPANY.

TENDERS FOR GAS COAL.

THE Directors of the above Company invite TENDERS for the supply of about 2000 Tons of unscreened SILKSTONE GAS COAL, and about 1500 Tons of SEABORNE GAS COAL, delivered at the G.N.R. Gas-Works Siding, Hertford.

Delivery to be as required over the Year ending May 31, 1903.

The Directors reserve the right of dividing the Contract.

Tenders, endorsed "Coal," to be sent in before the 20th of May.

ROBT. WATSON,
Manager and Secretary.

Gas-Works, Hertford,
May 10, 1902.

By order of the Directors of the

CROYDON COMMERCIAL GAS AND COKE COMPANY.

HOOKER & WEBB will sell by Auction, at the Greyhound Hotel, Croydon, on Thursday, the 29th of May, 1902, at Six o'clock precisely, in large and small lots,

£5000 CONSOLIDATED "C" ORDINARY STOCK

OF THE

CROYDON COMMERCIAL GAS AND COKE COMPANY,

which for some years has paid Dividends of 9 per cent. per annum, and since 1898 these have been paid free of Income-Tax.

Particulars and Conditions of Sale may be had of the SECRETARY of the Company, Katharine Street, Croydon and of the Auctioneers, 4, High Street, Croydon.

Telphone No.: 122 Croydon.

£1,000,000 worth of Gas per annum at least can be saved in England by using my AUTOMATIC GAS APPARATUS patented in England.

About 500,000 apparatus have been sold in Germany in three months (guaranteed), with over £7500 profit.

This Patent is TO BE SOLD at once.

Only principals need apply to the owner of the Patent, M. OFFENBERG, Luckauerstr. 3, BERLIN.

IMPERIAL CONTINENTAL GAS ASSOCIATION.
(INCORPORATED BY ACT OF PARLIAMENT.)

NOTICE is Hereby Given, that the Half-Yearly Ordinary General Meeting of the Proprietors of this Association was held, at the City Terminus Hotel, Cannon Street, London, on Tuesday, the 6th inst.—

THOMAS HENRY GOODWIN NEWTON, Esq., in the chair, when the following Resolutions were unanimously passed:

"That the Report of the Directors upon the affairs of the Association be received, adopted, and entered upon the minutes."

"That a dividend of 5 per cent. for the half year ended Dec. 31 last be declared upon the £3,800,000 Capital Stock of the Association, and that the same be payable, free of income-tax, on and after the 13th inst."

"That Clarence Pigou, Esq., be re-elected a Director of the Association."

"That the Hon. Sir Edward Chandos Leigh, K.C.B., K.C., be re-elected a Director of the Association."

"That John Horsley Palmer, Esq., be re-elected a Director of the Association."

"That Montagu Somes Pilcher, Esq., be re-elected an Auditor of the Association."

Votes of thanks were passed to the Directors for their able management of the affairs of the Association, to the Chairman for his conduct in the chair, and to the staff in London and on the Continent.

By order of the Board,
ROBERT W. WILSON,
Secretary.

21, Austin Friars, London, E.C.,
May 7, 1902.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his AUCTIONS of STOCKS and SHARES in London, Suburban, and Provincial Gas and Water Companies are held PERIODICALLY, at the Mart, Tokenhouse Yard, E.C.

He also undertakes the issuing by AUCTION of GAS and WATER STOCKS and SHARES under Parliamentary Powers.

Terms for issuing such Capital, and also for including Gas and Water Stocks and Shares in these periodical Sales, can be obtained on application at Mr. ALFRED RICHARDS' OFFICES, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the

WANDSWORTH AND PUTNEY GAS LIGHT AND COKE COMPANY.

ISSUE OF £8833 OF NEW THREE PER CENT. PERPETUAL DEBENTURE STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, May 27, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the

ROMFORD GAS AND COKE COMPANY, LTD.

NEW ISSUE OF 600 £5 "B" SHARES.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, May 27, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the

GREAT YARMOUTH WATER-WORKS COMPANY.

NEW ISSUE OF 500 £10 ORDINARY SHARES.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, May 27, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the

BOURNEMOUTH GAS AND WATER COMPANY.

NEW ISSUE OF 1000 £10 "B" SHARES.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, June 3, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the

TOTTENHAM AND EDMONTON GASLIGHT AND COKE COMPANY.

NEW ISSUE OF £10,000 ADDITIONAL "B" CONSOLIDATED STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, June 3, at Two o'clock precisely, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the

WALTON-ON-THAMES AND WEYBRIDGE GAS COMPANY.

NEW ISSUE OF 150 £10 "B" SHARES.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, June 3, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBU CIRCUS, E.C.